

AMATEUR TELEVISION QUARTERLY

VOLUME 9 #1
WINTER 1996

ISSN 1042-
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*Olym-PICS: "Skimpy" work's camera for KK9T's antenna work.
Thanks to Dave Mitschelen for this cover photo*

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AMATEUR TELEVISION QUARTERLY

VOLUME 9 #1 WINTER 1996

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Translations: Andrew Emmerson G8PTH
Re-draft of drawings by Bill Parker W8DMR
Typist, Debra Gillespie

COVER PHOTO

The critics, KK9T, N9LWD, KB9MT, find help with their video from "Skimpy" their camera person. Next time someone asks you why you like ham TV... just say, "the pictures are great!"

Now turn the pages to our Winter Olym-PICS contest and join in the fun. So far the Hoosiers have a head start! Hey ATN, any good California pictures to rival our midwest submissions? Do I hear a Beach Boys song in the background...

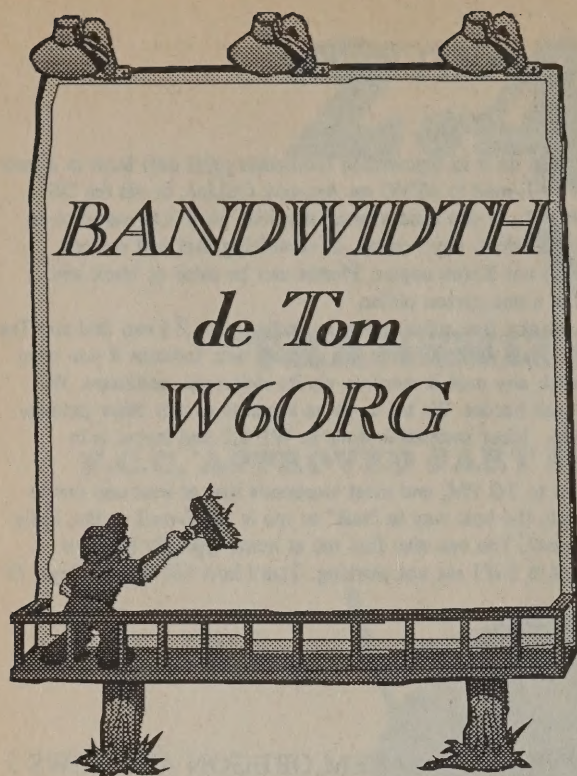
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Because my work schedule starts at 7 am to 7-9 PM, and most weekends lose at least one day to remotes and other broadcast stuff at my real life job, the best way to "talk" to me is via E-mail or fax, lastly the answering machine. I get to it about once a week. You can also find me at home typically Sundays between 10 and 4 if I'm not working, or Saturday 9 to 3 if I am not working. That's how life is these days. 73
Henry KB9FO

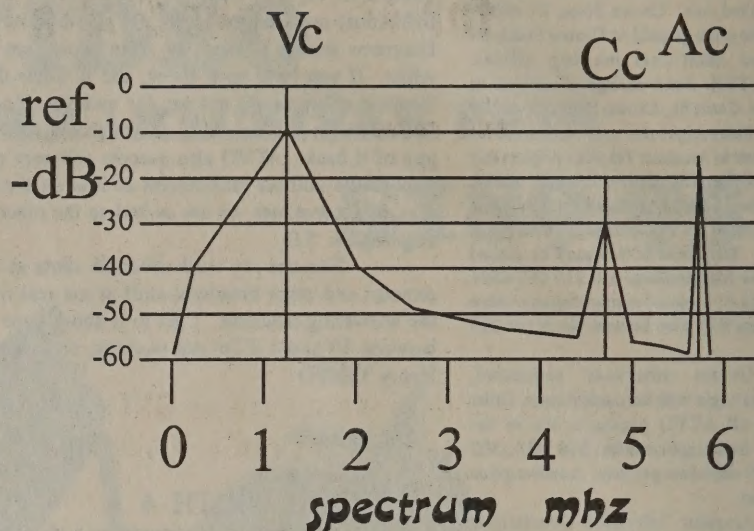
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This issue was sent to the printer January 22, 1996. The deadline for the next issue is March 15, 1996. This puts us back on schedule. This issue represents creative new thinking about our ATV publication. Your feed back is important. Please take a moment and send in your thoughts. The new layout and other creative features are intended to attract new readers. Also, the IN box is empty again! Send in your articles and news for the next (Spring) issue. See you at Dayton! An effort is being made to have a Friday night ATV meeting. More information next issue. Watch for it!



relative amplitude of
video signal components
diagram by KB9FO



We hear all kinds of numbers thrown around for ATV bandwidth. Those looking for spectrum for other modes most often have a false impression if not defined correctly to them. No wonder they think we are band hogs. Most I have talked to think in terms of FM where the spectrum power density is equally high over the whole bandwidth - not so with TV. Bandwidth really depends on what one is talking about, so here are some Definitions.

Occupied Bandwidth: Per FCC Rules 97.3(a)(8) it is the width of a frequency band outside of which the mean power of the transmitted signal is at least 26 dB below the mean power of the transmitted signal within the band. ATV luminance video (the black and white part) is actually less than 2 MHz.

Carson's Rule for FM Occupied Bandwidth: 2 times the deviation plus 2 times the highest modulating frequency. i.e. 2×5 kHz deviation plus 2×3 kHz voice or digital equals 16 kHz.

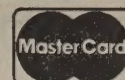
ATV Transmitted Bandwidth: Down greater than 40 dBc +/- 1 MHz of the video carrier (Television Engineering Handbook - 1992 - Benson - Fig. 5-11) plus color subcarrier at 3.58 MHz Down greater than 22 dBc (all red screen) and sound subcarrier 4.5 MHz greater than 15

dBc. Note this is true for both DSB and VSB. VSB has lower color and sound subcarriers attenuated additionally by the VSB filter response curve starting at -1.25 MHz below the video carrier.

Standard TV channel bandwidth: 6 MHz, video carrier 1.25 MHz up from lower edge. While the transmitted video is many tens of dB below the peak envelope power (sync tip) and random (not unlike spread spectrum) the TV receiver IF and detector bandwidth must be almost flat across the whole 4.2 MHz to maintain the transmitted relative video to sync ratio. **Normal instantaneous luminance video response bandwidth:** 3 MHz. **Highest instantaneous video response bandwidth including color:** 4.2 MHz.

This is why ATV stations receive more interference than transmit it. Most narrow band modes will never notice an ATV transmitter on the air if they are operating between 1 and 3.4 MHz. or 3.8 and 4.3 MHz. from a video carrier. The actual spectrum power density is about the same as license free FCC part 15 field strength with a 10 Watt ATV transmitter in these 2.4 and .5 MHz segments within the ATV channel. However, any narrow band transmissions greater than one micro-volt within the 6 MHz channel can interfere with the picture. De Tom, W6ORG

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EZ SSTV

From: k2ga@ACY.DIGEX.NET (Michael Ward)

For those of you who are interested in Slow Scan TV on the ham bands, there is a really nice little program (799138 bytes!) available as EZSSTV.ZIP If anyone is interested, please let me know and I will tell you more. 73 de, K2GA • Michael Ward, Millville, NJ (609) 327-2188 • k2ga@acy.digex.net (INTERNET) w2hob@#snj.nj.usa.na (Ham Radio) • BYHA98A (Prodigy)

KNOXVILLE

Hello all. There have been two ATV repeaters in Knoxville, TN for a while now. One of the repeaters is an in-band on 439.25 MHz input and 321.25 MHz output horizontal polarization. The other is a cross-band repeater with input on 426.25 MHz and the output on 1253.250 MHz. The in-band has been up since December 1990 and the cross band has been up since September 1993. Both are AM modulation. I have been trying to figure out a way to tap my son's Super Nintendo and use the graphics for some fancy ID's. Any ideas?? Bill Curb WA4CDM

MINNESOTA

Hi! Here in Minnesota several of us ATVers are using VGA to NTSC converters. It's just another good source of interesting subject matter to transmit. Computers offer so many topics...games, pictures, text, etc. These converters are cheap now too. Rollie KBOGL

SALEM, OR RPT

There is a new ATV repeater on the air here in Salem, OR. The call is W7SAA and it is working well. Some more improvements need to be made but, for the moment, it really works great. It is a crossband operation, 426.25 MHz in and 1253.25 MHz out. It is on a commercial TV tower 17 miles east of Salem at an elevation of 1425 feet. It has very good coverage here and as far as Portland. 73 Robert Boswell W7LOU

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ATVQ Magazine and books available from:

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KREEPIE PEEPIE POWER

In the last ATVQ, Steve, KE6JGK, asked about varying the KPA5 transmitter power output like was designed into the TXA5-RC from 1.5 watts down to .1 watts. Some of the larger R/C models can take the wider board and like to have the sound built in to here the engine sound change when it is diving or climbing. The fancier ones use the sound subcarrier to feed back data. One can just add the FMA5 subcarrier board to the TXA5-RC transmitter, but some like it all on one with the KPA5-F.

The present revision F board of the KPA5 I found was stable through all positions of capacitor C7 which is used to lower the power and did not degrade the video. This is not true of previous revisions however. A miss match can cause spurious oscillations, so unless you have a spectrum analyzer, I suggest not trying it with older KPA5 revision boards. In fact some have gotten into trouble detuning other trimmers which decreased the power out but distorted the video or splattered the band.

C7 is the variable tuning cap that is connected to the base of the MRF555 final transistor and will vary the drive. However, do not repeak any of the other trimmer caps after you set the desired power output with C7. If your board is out of tune, it must be repeaked before resetting C7 for less than maximum power can be done. As with all our ATV transmitters any peaking must be done with no video connected, the pedestal pot at maximum power out, and then reset to 60% power or 75% at the output voltage test point. Follow the tune-up procedure on the data sheet.

MINI-AMP UPed

RF Concepts just upped their prices effective Feb. 1. Could it be from the favorable review in the last issue of ATVQ? The new Mini-Amp 440 went up \$10, but it is still a good deal at \$120. However I did get some stock at the old price and will hold the \$110 until I have to reorder after Feb. 1. The 4-110 100 Watt amps are going up also but just a few dollars.

As of this writing, mid January, I have not received any Mirage amps but they are now down to saying next week. I know there are a number of 400 MHz ATV repeaters out there anxiously awaiting their repeater amps. Hopefully they will be out before the end of the month.

CAN'T SPELL TALLAHASSEE

I apologize to all those that tried to get on the ATV remailer and got their Email bounced back. I left out an L in Tallahassee in my column last issue. To get on the ATV Email net, send a message to: LISTPROC @TALLAHASSEE.NET Just put the words SUBSCRIBE ATV in the text, nothing else. You will get a message back if successful. Again, it does not cost anything and it is a good way to keep up on what is happening, and a forum to ask

questions or get info. Some other interesting internet addresses for you ATV cyber surfers are the web pages of the various ATV clubs and ATV repeater groups. Many are linked, so that when you bring up one, you can bring up the others. Might be interesting to point your ATV camera at the computer screen and transmit the web pages to those that are cyber-challenged.

So. Calif. Amateur Television Network: <http://www.portal.com/~jpawluk/KB6MMF.html>

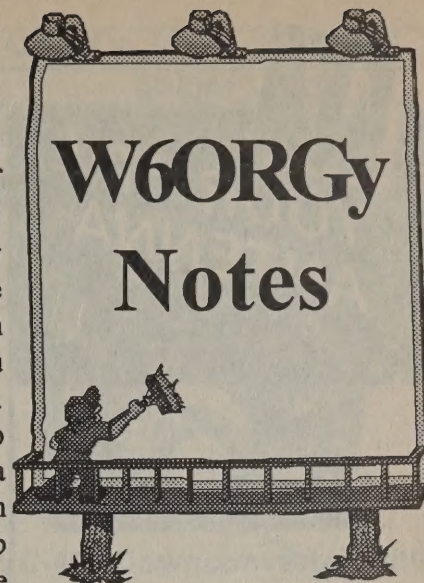
ATCO - Amateur Television in Central Ohio <http://psycho.psy.ohio-state.edu:80/atco/>

Atlanta Amateur Television Network <http://www.mindspring.com/~rwl/aatn1.html>

Houston - HATS <http://www.stevens.com/HATS/home.html>

NATIONAL FREQ. COORDINATION

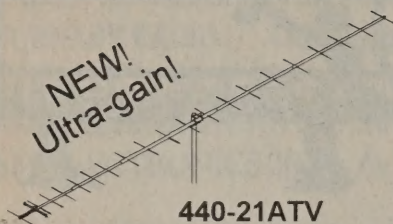
Well it is just out - First draft of the Bylaws and Articles of Incorporation of the National Frequency Coordination Council and Memorandum of Understanding with the ARRL. Frequency coordinators have complained that they have no back up from the FCC when it comes to conflicts. From the coordinators point of view, incorporating a national organization that will be the single point of contact with the FCC and ARRL is the first step to solving this problem. While all repeat modes are mentioned in their Articles, their main interest and problems were with FM voice repeaters, their third purpose does mention "promulgate proper policies for cooperation and interference avoidance among and between users". We have to make sure that all users of the band are considered. How this new organization will fit in with overall band planning and spectrum management will have to be ironed out after adoption of the Articles and memorandum of agreement with the ARRL and FCC and applied locally. Local coordinators will have to have time to figure how they can work with the new national organization and how that affects their local problems. That is when we as ATVers must get involved to make sure that ALL amateurs are considered. Watch future issues of ATVQ, QST and other magazines. Get on the ATV remailer net, and keep up on this momentous event - it will affect us all for some time to come. 73, Tom O'Hara, W6ORG tomsmb@aol.com





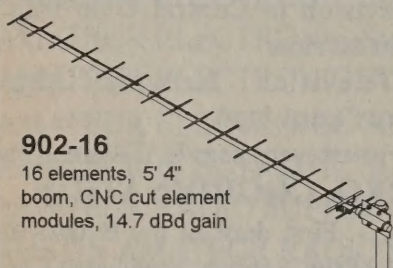
YOUR ATV ANTENNA SOURCE ...

NEW!
Ultra-gain!



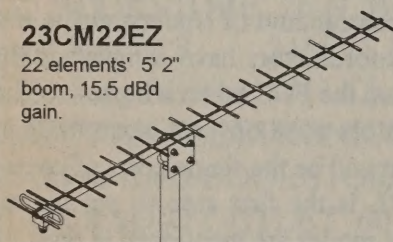
440-21ATV

all-weather replacement for FO22,
sealed driven element, 14' 5" tapered boom
(1-1/2", 1-1/4", 1"), >15.9 dBd gain.



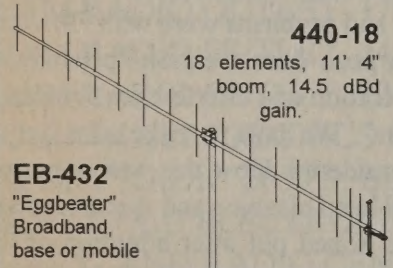
902-16

16 elements, 5' 4"
boom, CNC cut element
modules, 14.7 dBd gain



23CM22EZ

22 elements, 5' 2"
boom, 15.5 dBd
gain.

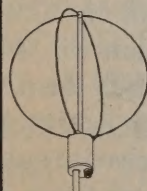


440-18

18 elements, 11' 4"
boom, 14.5 dBd
gain.

EB-432

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Broadband,
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ATV Winter

Olym-pics

CONTEST!!

(or summer Olym-pics for you folks in Florida and southern California 'cause you never have one of our winters!)

Categories:

Best... or worst...

minicam operator

Antenna erection

repeater operation

home studio

out door sport

in door sport

through the door sport

H-T holder

best/worst looking ATV'er

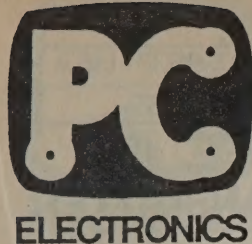
best/worst looking cable installer/cutter

mobile ATV (any vehicle)

Special Olym-pics: anything we didn't think of that is special to you!

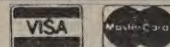
Rules: Anyone can enter! Enter as often as you want. Submit your entry in photo form, or video form, or film form, or in bad form! Our sex starved judges after a few 807's will choose the winner in each category to be published/announced in our hallowed pages of ATVQ. This should be a fun/serious effort to release your pent up creativity or frustration. Entry's may be from actual events or you can "stage" the event for the camera. The only restriction, there must be something about video in the picture. To give you some incentive, the first winner in on our cover! Note: it was limited to one entry so we could fix the results in true Chicago Political Tradition. You can also offer bribes to the judges and we will include these "offers of good will" in the write-up of the entry's. ie: "If you print this here ugly picture of my ugly ____ in-law I will donate a 45 element 40 meter beam to your antenna farm."

Yes this is a serious contest and we will find something to give to the top winners....even if its just raspberries ...jam. DEADLINE FOR ENTRIES: June 15, 1996. Mail to: ATVQ/TSQ Olym-pics 3 N. Court St., Crown Point, IN 46307.



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- * Transmit RF detected composite video outputs to monitor phono jack on back to see what you are transmitting. In receive you see your own direct camera video at this jack to enable focus and lighting set-up before flipping the switch into transmit.
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- * Small rugged shielded cabinet - 7.3 x 4.7 x 2.1", 1lb. 11 oz.

Just plug in your camera, VCR, camcorder, etc. composite video and audio, 70cm antenna, 12 to 14 Vdc @ .5A, and you are ready to transmit live action color or black and white pictures with sound to other amateurs. Specify 439.25, 434.0, 427.25 or 426.25 MHz transmit frequency. 1 crystal included, second crystal add \$20.

*Transmitting equipment sold only to licensed Tech class or higher radio amateurs verified in the Callbook for legal purposes. If newly licensed, moved or upgraded, mail or fax copy of license or test certification.

WHAT ELSE DOES IT TAKE TO GET ON ATV?

Any code free Tech class or higher amateur can get on 70cm ATV with full color and sound. Any video camera, camcorder, VCR or computer with a composite video output can be plugged into the front panel phono jacks for both audio and video transmission.

Start by selecting a 70cm antenna and connecting a TVC-4G downconverter to your TV set to receive. Add the Transmitter along with your camcorder and 13.8 Vdc from a regulated power supply capable of .5 Amps and you are on the air. It's easy!

DX with TX70-1b's and KLM 440-16X antennas line of sight and snow free is over 22 miles, 7 miles with the 440-6X normally used for portable uses like parades, races, search & rescue, damage assessment, etc. For greater DX or punching thru obstacles add either of the ATV compatible 15, 50 or 70 watt amps listed below.

The TX70-1b has full bandwidth for color, sound and live action just like broadcast. You can show the shack, home video tapes, computer programs, repeat SSTV, weather radar, or even Space Shuttle video if you have a home satellite receiver. See 85 to 94 ARRL Handbook chapters 20 & 7, or new 1995-6 edition chapt. 12 for more info and Repeater Directory for local ATV repeaters.

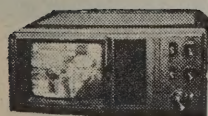
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If you order both the TX70-1b and the TVC-4G at the same time, the special package price is \$349

Most telephone orders shipped within 24 Hours

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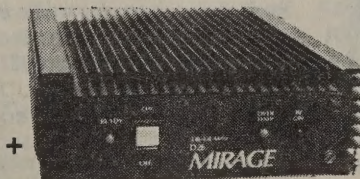
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D26N



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Specify frequency(s)
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or 426.25 MHz
2nd crystal add \$20

13.8 Vdc
@ .5A Power Supply
required

Optional matching Amplifiers

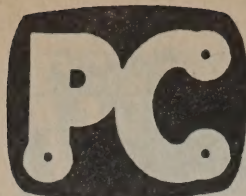
RFC Mini-Amp 440-N 12-18W out ..\$110
Mirage D15N 15 Watts RF out\$176
Mirage D26N 50 Watts RF out\$249
Mirage D100ATVN 70 Watts out ..\$369

Antennas see page 5

Rutland F022-ATV 15.8 dBd..\$139
Swiech COY43419EL 14dBd \$129
KLM 440-16X 14 dBd\$139
KLM 440-10X 11 dBd\$77
KLM 440-6X 8.9 dBd\$60

Remember when comparing prices, ours include UPS surface shipping in cont. USA.

HAMS, call (818) 447-4565 now for your complete 10 page catalogue of our ATV products!



P.C. ELECTRONICS 2522 PAXSON LANE ARCADIA CA 91007-8537 USA

TOM (W6ORG) & MARYANN (WB6YSS) O'HARA

(818) 447-4565

24 hr FAX order line (818) 447-0489

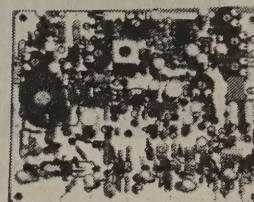
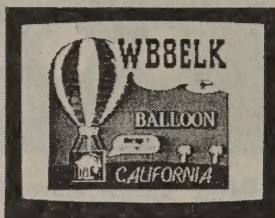
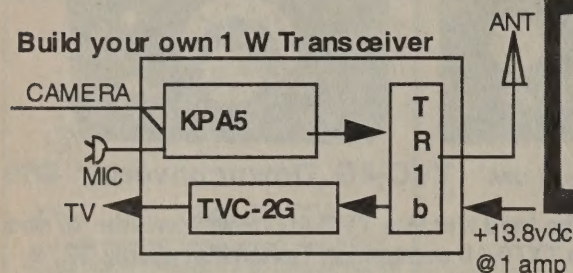


ELECTRONICS

THE "KREEPIE PEEPIE" ATV TRANSMITTER

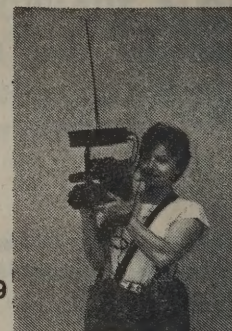
THIS IS THE 420 - 450 MHz BAND ATV TRANSMITTER BOARD YOU HAVE READ ABOUT THAT HAS SURVIVED MANY BALLOON FLIGHTS TO OVER 100,000 FEET AND BACK. ALSO USED FOR R/C MODELS WHERE AN ALL IN ONE BOARD WITH SOUND IS DESIRED OR FOR DEDICATED LINKS AND REPEATERS. JUST THE THING FOR THE BUILDER WHO WANTS TO PACKAGE AND MAKE HIS OWN PORTABLE OR HOME TRANSCEIVER WITH A WIRED AND TESTED BOARD.

Build your own 1 W Transceiver



3.25 x 4"

KPA5-F board only \$169



KPA5-F 70CM ATV XMTR BOARD FEATURES:

- 1.5 Watts P.E.P. typical RF output. Run barefoot for portable, but if needed for greater DX, the output properly matches the Mirage D15N 15 watt, D26N-ATV 50 Watt linear amp for full output or D100TVN to over 70 Watts with its adjustable sync stretcher. Same board as used in TX70-1b.
- FULL COLOR AND SOUND on a small 3.25 x 4" board
- Wired and tested board runs on external 13.8 Vdc @ 300 mA. supply or 12 V battery. Weighs only 3 oz.
- Accepts composite video from cameras, camcorders, VCRs, computers, etc. 2 audio inputs, one for low Z dynamic mic, & one line level from most cameras & VCRs. Transmit monitor output enables seeing your own true RF detected video.

ACCESSORIES:

- L.M.B. CAB247 7.3x4.7x2" roomy aluminum box.....\$22
- CAB234 4.6x3.6x2" aluminum box, smaller tighter fit.....\$14
- 100 Ohm carbon panel pot for video gain control.....\$5
- TR-1b RF T/R relay module, mounts on chassis N conn.....\$29
- UG58 N fem.chassis jack..\$2. UG21 male 9913 plug..\$5
- TVC-4G..\$89 or TVC-2G..\$49 Downconverter (pg 5)
- RG174 50 Ohm 1/10 inch dia. coax cable, 6ft.....\$3
- RF CONCEPTS Mini-Amp 440-N 1.5 in /12-18 out ...\$119
- MIRAGE D15N-ATV 1.5 in /15 out all mode amp.....\$176
- MIRAGE D26N-ATV 1.5 in / 50 out all mode amp.....\$249

KPA5 APPLICATION:

PORTABLE CORDLESS TV CAMERA. Think of it as a video HT. Place the KPA5 in one of the L.M.B. Diecast aluminum boxes, Diamond RH77CA half wave on top or at the end of 50Ω coax attached to a headset. Plug into a 12 to 13.8V source such as a 12 Vdc battery pack. Depending on terrain & receiving antenna DX is typically over 1 mile. Then at home with KLM 440-16X antennas at both ends DX is >22 miles snow-free line-of-sight.

Price only \$169 supplied with one crystal on 426.25, 434.0, 427.25 or 439.25. 2nd xtal add \$20. Has 2 relay switched crystal sockets. Specify frequency(s) when ordering, check with local ATVers, ARRL Repeater Directory or call us. Sold only to code free Technician class or higher licensed radio amateurs.

- MIRAGE D100TVN 1.5 in/70 out all mode amp.....\$369
- DIAMOND RH77CA 2m/70cm omni antenna, BNC, 15"...\$30
- DIAMOND RH951 2m/70/23cm omni antenna, BNC, 15"...\$52
- DIAMOND NR-770H 2m/70cm mobile ant. , UHF, 3/5.5 dB\$59
- DIAMOND MX-72N 2m/70cm antenna duplexer.....\$59
- AEA 450 ISPOLE omni 4 dBd vert. gain antenna, N...\$89
- KLM 440-6X 8.9 dBd ant., 28" boom, >50 deg. BW.....\$60
- KLM 440-10X 11.2 dBd, antenna, 64" boom.....\$77
- KLM 440-16X 14.2 dBd antenna, 10.5 ft boom...\$139
- 1000 pF Feed-thru Cap for R/C or repeater builders.....\$4

SMALL TXA5-RC 1 WATT ATV TRANSMITTER.....\$129

Designed primarily for Radio Control models, rockets, balloons, etc. with it's small 2.25 x 4 inch size and 2 oz. weight. Adjustable power output from 1.5 p.e.p. to 100 mW. Draws 350 MA @ 13.8 Vdc at 1 Watt, 200 ma at 100 mW. Has adjustable sync stretcher and provisions for sound from the FMA5-F board (pg 2) in case your application needs higher power sometimes or subcarrier sound. Comes wired and tested ready for you to mount in a shielded enclosure, connect up coax from antenna and camera and wires to power source. Plan on shielding your R/C receiver and adding the simple antenna low pass filter supplied with the application note. Receive with one of our 70 cm downconverters listed on page 5 and a TV set. Specify freq., 426.25 MHz suggested for R/C, other standard ATV freq. avail.

TXA5-70b board can also be used for R/C applications where 2 frequency capability is desired. Same size as TXA5-RC but 80 mw.for .25 to 5 mile DX, or add 10 Watt PA5 amp for 3 to over 100 mile line of sight DX. See page 2....\$89

MICROTEK ATVM-70 MINI ATV transmitter board.....\$209

Only 1.0 x 1.3 inch, wired and tested board. See article in July 91 73 Magazine page 9. Nominal output 80 mw. Capable of driving the PA5 for higher power. Requires 7.0 to 10.0 Vdc maximum at <100 ma. Only 434.0 MHz is available with the SAW oscillator. Also Great for R/C models, robots, demos or short links. Snow free line of sight DX 1/4 mile dipole to dipole or up to 5 miles with KLM 440-16X beam antennas.

MSC-2 companion 4.5 MHz sound subcarrier board, same board size as ATVM70...\$59

Remember when comparing prices, ours include UPS surface shipping in cont. USA.

1/96

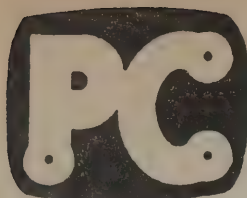


TXA5-RC 2.25 x 4"



ATVM-70 Transmitter MSC-2 Sound

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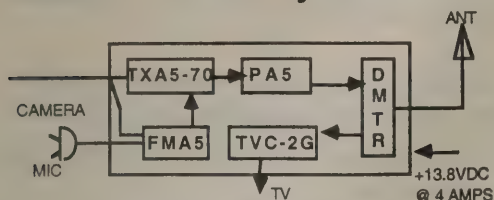
24 hr FAX order line (818) 447-0489



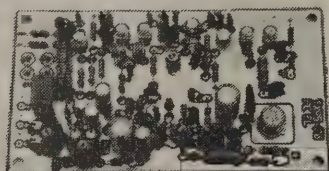
ELECTRONICS

BUILD YOUR OWN 70 cm 10 Watt ATV STATION

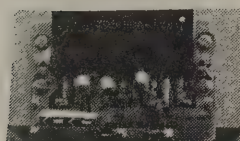
Basic 10 Watt system - 3 Transmitting modules as seen in the Handbook



420-450 MHz BAND



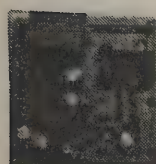
TXA5-70B 4.0"x2.25"



PA5 3.5"x2.0"



FMA5-F 3"x1.5"



DMTR-70-10 2.2x2.2"



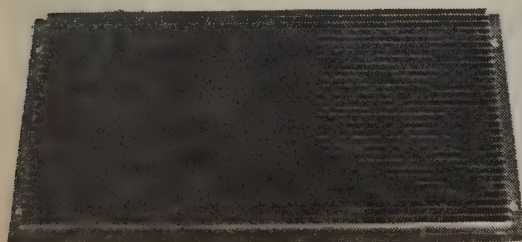
TR-1b 2 x 1.8"



RFC 4-110



D1010N-ATV or D100ATVN



D1010ATV-R or D100ATV-R

See chapters 20 & 7 in the 85 to 94 ARRL Handbook or chapter 12 in 1995-6. These modules are the latest upgraded generations. Mount the boards & parts for a 10 to 15 Watt basic module ATV transceiver in a 3x8x12" aluminum chassis for shielding and heat sinking, or Hammond 1590F die cast aluminum box like we did for the TC70-10. Use the DMTR-70-10 module to switch your 50Ω 70cm antenna between PA5 amp and TVC-2G (page 5) downconverter. Schematic & layout comes with each module.

TXA5-70b ATV EXCITER/MODULATOR.....\$89

Replaces TXA5-5. Smaller board for stand alone portable or R/C applications in addition to 10 Watt systems. Wired and tested board. Adjustable 50-80 mW output to properly drive the PA5 10 Watt module and in turn the 100W 4-110 or D1010N-ATV. Built-in sync stretcher. Accepts standard 1 volt composite video from color camera, VCR, computer, etc. Wideband modulator gives excellent color and high resolution. Draws 70 mA at 13.8 Vdc. One crystal included, but relay switch between 2 sockets. **Extra crystals \$20.**

We stock 439.25, 434.0, 427.25 & 426.25 MHz, other 70 cm freq. may take 4 weeks to special order xtal. 100 Ohm carbon panel pot for video gain \$5.

PA5 10 WATT P.E.P. ATV POWER MODULE.....\$99

An all mode Toshiba S-AU4 is mounted on a heatsink with a stripline PC board to output over 10 Watts p.e.p. when driven by 80 mW from the TXA5-70. 50 Ohms in & out. Broadband, 420-450 MHz, linear, no tuning. 250 mW max RF input, do not use with 1 Watt modules. req. 13.8Vdc reg. @ 3 amps.

FMA5-F AUDIO SUBCARRIER GENERATOR.....\$39

Temperature stabilized VCO with adjustable deviation to more than 25 kHz. Transmits broadcast standard sound with your picture. Accepts a Low Z mic (100-600 Ohms), also line level audio from VCRs, camera mics, computers, etc. Up to 1 v pk-pk drive to the TXA5-70, TXA5-RC or TXA5-33 exciter modulators. Works with any transmitter having 5 MHz modulation bandwidth. Draws 20 ma from 13.8 Vdc supply. We can special set the freq. for FM or PAL up to 6.8 MHz.

DMTR-70-10 T/R RELAY, DETECTOR & MONITOR.....\$45

T/R switching for up to 15 Watt 70cm ATV systems. Negligible insertion loss, 60dB isolation. Mounts on flange type UG58 N chassis jack (\$2). Relays for switching + power to all basic modules, camera video in rec. to detected output video in xmit. to monitor. 2.2x2.2". 13.8Vdc @ 120 ma.

TR-1b 70cm T/R RELAY BOARD.....\$29

Simple 15W T/R relay and up to 1A +13.8 power relay. Mounts on UG58 jack.

4-110 RF CONCEPTS 100 WATT P.E.P. AMP.....\$359

420-450 MHz all mode: FM, SSB, CW, & ATV. Good color and sound from the 10 Watt basic modules or TC70-10. Sync power (p.e.p.) 100 Watts with blanking set for 60 Watts (6-7 Watt sync, 2-3 Watt blanking set up). ATV duty cycle 10 min on/5 off, other modes 5 on/5 off. RF sense T/R switching. 12x3x5.5". Req. 13.8 Vdc @ 22A. 15 Watts max drive. Receive Preamp.

MIRAGE D1010N-ATV similar TX specs as 4-110, req 13.8 Vdc @20A..\$369

D1010ATV-R MIRAGE 70CM REPEATER AMP.....\$589

Continuous duty version of D1010N. Made to match TXA5-70/PA5 10 Watt modules. Rugged large heat sink for repeater or long key down time. 100 Watts p.e.p. or 80 Watts CW. 8.75" H 19" rack panel. T/R switch add \$35.

D100ATV-R repeater version gets 90 Watts p.e.p. for 1.5 Watts drive from RTX-70 repeater transmitter (pg 6) or KPA5. 7 Watts drive limitation...\$589

D100ATVN MIRAGE 1.5 in/>70 WATT OUT AMP.....\$369

Designed to match our TX70-1b, TC70-1d, TXA5-RC and KPA5 1.5 Watt transmitters. 7 Watt maximum drive, cannot be used with the 10 Watt modules. All other specs the same as the D1010N.

Remember when comparing prices, ours include UPS surface shipping in cont. USA.

1/96

HAMS, call (818) 447-4565 now for your complete 10 page catalogue of our ATV products!

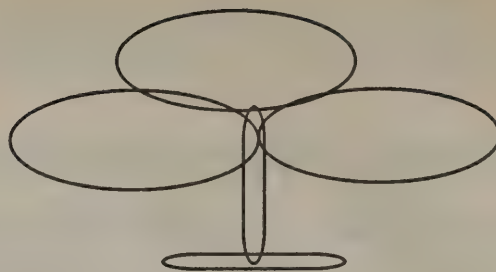


Two ways of mounting the Wheel are described here. If you have an existing mast mounted on a Mag mount (like the Hustler 22" short mast for HF) you can use it directly. All you need is a matching thread nut to secure the bracket on top of the mast. If you don't have a Hustler or similar mast, one can be made from 3/8" thread rod (found in most hardware stores) cut 16-1/4" (5/8 wave on 70 cm) and fastened to a mobile magnet mount. The mounting of the "Wheel" antenna is a flat sheet aluminum bracket 2" long and 1-1/4" wide. Drill a 5/8" hole in the center 3/4" (center) from one end. Drill a 3/8 hole 5/8" in from the other end. 1-1/4 " wide

Mount the antenna to the 5/8" hole and secure with a second "N" connector nut. Mount the antenna to the mast. The antenna is now ready for tuning & testing. Use good quality RG 8x feed line even for very short runs. RG 58 has too much loss even at 400Mhz!

Tuning & Testing the Wheel Antenna & Checking Resonant Frequency

Check the SWR on the frequency it will be used (ie 439.25 /427.25 or 1280/1255). If the VSWR is 1.2/1 or less, it will work fine for receiving the output of the



repeater. If the VSWR is very high ($> 3:1$), check for a feed line problem (connector). If the VSWR is reasonable, no further tuning is necessary. If you would like to fine tune the antenna, the following procedure worked for me.

A good quality watt/SWR meter (like a Bird 43 or Diamond SX1000) for the 70 or 23 cm band is necessary to check out the antenna. Using a 440/1200 transmitter that will tune 430 to 450 Mhz, or 1250 to 1290 plot the VSWR curve for the antenna. To raise the center frequency, bend each element (slightly) using pliers at the point the element soldered to the brass disks to separate the 1/4 wave feed section; of the clover leaf. Plot the curve again. Repeat as often as necessary to obtain the desired center.

Checking the Pattern

A very rough check of the OMNI directional pattern can be performed by using the repeater BEACON mode as a signal source. Use a Decade attenuator box to add enough attenuation to reduce the repeater signal to about "P2". In an "open" area and line of sight with the repeater, rotate the antenna while mounted over the car roof on the Mag mount. Watching the picture, you should see no change in picture strength. The antenna has been measured with a far more sensitive equipment to have -0.3db nulls 120 degrees apart in the OMNI pattern. These nulls can not be detected by watching the TV monitor (it takes 3db to change the picture 1/2 a "P" unit. If you have a sensitive IF AGC "P" meter on your ATV receiver, you may be able to detect the -0.3db nulls.

A final word

Don't expect this antenna to perform like your Beam or Loop Yagi! It does, however, perform like a Horizontal, OMNI Directional unity gain antenna. Using the 70 cm version, I routinely copy the Columbus repeater while mobile "P2" 40 miles from Columbus and with the 23cm version, I can see the repeater anywhere in the Columbus area (12-15 Miles), shorter distances when the leaves are on the trees!

If you would like to buy this antenna ready made and tested, contact "The Olde Antenna Lab" in Denver, CO (303-798-5926). The basic antenna sells for \$44.95 and a Mag Mount version sells for \$59.95. (check prices before ordering)

If you build this antenna, please let me know your experience with it. I have a Wheel antenna mounted up about 40 feet on my tower, if you would like to have a "Wheel to Wheel" contact, let me know! 73 & CU on ATV Ken...WA8RUT

DETROIT ATV REPEATER

From: murphy@mail.msen.com

I'm about to install and AM ATV repeater here in the Detroit area and am quite excited. I have worked for many months getting a good site, insurance, you get the idea. I'm hoping to get a few questions answered. I have received coordination for 434.0 in (I guess all users will have to use a VSB filter so the extra RF doesn't get below 430MHz A-LINE)) and 1241.25 out. I'm going to attempt to use a dual band (440/1.2) antenna with a mobil duplexer (of course I have VSB filters.) One concern I have is the antenna (diamond U-300) antenna specs show 1260MHz to 1300MHz operation. At 1260MHz it's a 1.5 VSWR.

1) Is this antenna useless for my 1241.25 (1240-1246) output? I assume the SWR will be through the ceiling.

2) I have a 1.2GHz FM repeater at the same site. 28 feet horz separation and can't get more than 5 feet vertical separation. I'm concerned with the ATV repeater interfering. I was told a notch filter may work. Do I notch my voice repeater (1282.40) output freq and -12 MHz input freq and put this filter on the ATV transmitter? Where would I purchase one of these?

3) I've tried several times to subscribe to ATVQ but the answering machine doesn't let me leave a message. Is there a better way?

4) How do I let ATVers in my area know there's a repeater up? I assume next years ARRL repeater directory will list it but I would like people to use it before then! I'm really hoping to promote the hobby in my area.

If I can get an answer to any of the questions I would really appreciate it. Thanks so much, Chris N8UDK (tech-lite!) chris@murphyco.com



REPLY:

The main problem with high vain vertical or multi-band vertical antennas is "beam steering" and gain drop-off. As the frequency changes, so does the pattern of the antenna. While in phase at the rated frequency, the pattern begins to fall apart as you get beyond the frequency range. The fields from each element are no longer in proper phase and the nulls get deeper, and the gain smaller. The lobes also begin to move in elevation. While the main lobe is supposed to be at the horizon, with a shift in frequency, this also changes to some elevated angle. In commercial TV antennas this is a problem because it changes the ratio of the received audio/video and color information. The antennas are carefully tuned element by element to compensate for frequency (bandwidth). Without it a smulti slot antenna can have 4-6 dB "loss" at the sound carrier vs the vision carrier because the vertical patterns are not the same 4.5 MHz apart. The higher the gain the worse the problem.

In November we replaced the R/S tape based answering machine with an AT&T digital machine. Messages are getting through better. The best way is via E-mail on America OnLine ATVQ@AOL.COM.

Contact the ARROW ATV repeater group in Ann Arbor for local help in publicising your system. ALso 144.34 FM simplex for QSO's.

For Interference, see our explanations in this issue about FM to TV/ TV to FM interference considerations. Notch filter is likely not necessary. 73
Henry KB9FO

Here are some of the notes that pass across my computer screen from America OnLine.

ATVQ on America Online

**REACH ATVQ VIA
E-MAIL from any
computer service :
ATVQ @AOL.COM.**

S band Antenna help - Please

From: Tomfaux

I'm conducting an experiment that would require a portable S-band (2.3 GHz) receiving antenna. Does anyone know what would be my best option (Yagi?, Parabolic Reflector??), and manufacturer. I need at least 30 dB gain to receiver a very weak 300 KHz bandwidth signal. Please help. Tomfaux

**Jim Reese, link coordinator,
TEXAS VHF Society wrote:
Yes FM wants to kick
everyone else off the band.
ATV wants large amounts of
spectrum for exclusive use.**

WRONG AGAIN! So far, the only band users with exclusive use of any portion are FM mode users. Everyone else is already sharing. The FM users now want more space for exclusive use, while having poorly used what they already have. Lots of repeaters, mostly empty air time. ATV Wants to continue SHARING what we already are USING. ATV simplex has been using 439.25 (438-444) for over 40 years. If we use the vestigial lowside band operation many have been forced to use because of interference from FM repeaters, (434-440) we are sharing with AMSAT, and packet users. We already share the 421.25 or 426.25 "channels" with links and itinerant users, packet and weak signal stations. ATV IS A WEAK SIGNAL operation. not a robust FM operation.

ATV is mostly SIMPLEX/DX operation. Only 440 band offers this on a consistent basis. 900/1200 work for short distances where there is low foliage density. AEA made a prototype 900 MHz unit and never brought it to

market because they couldn't QSO in Seattle area because of the trees. Fixed link operations are best on the highest bands possible. 1240 is a good place for these, along with 900. The cost of an ATV repeater is over \$5,000. The cost of an FM repeater is about \$1500. You can buy the FM repeater off the shelf from Icom, Kenwood etc, for 400 or 1200. You cannot buy an ATV repeater off the shelf at any cost.

FM is a robust signal. TV is a fragile signal. When two FM signals collide, the ratio of desired to undesired for a saturated receiver is about 6-10 dB before there is interference. (depends on receiver design and "limiter" action. Thus a signal more than 10 dB below the desired signal is never heard until you unkey. A video signal has sidebands with energies less than 40 dBc, 40 dB below the carrier. A signal which is more than -40 dBc D/U interferes with the video. When an FM carrier invades the video receiver (TV set) it blanks the screen, or turns the picture negative, or otherwise causes interference to the video. You see it IMMEDIATELY. There goes your QSO video.

ATV also has viewers who are not hams. Many watch ATV because we re-transmit NASA shuttle vi-deo. Many ATV repeaters also provide NASA shuttle video and other ham public serviced activities. A regular TV set or VCR can receive the 440 band video. This lets the public/non hams watch, and also hams with a minimum of equipment to watch. This is not possible on 900 or 1200. No one except scanner listeners follow FM voice communications. They can already tune 900 or 1200 on many scanners.

We don't have to justify our existence any more than any other ham/mode users. The FCC justifies our existence with permitted emissions. No one, not you, not any Frequency Coordinator, not the ARRL, not a FM Repeater council can order us or anyone else off the band. No one has the legal authority, period. Go read the Code of Federal Regulations (CAR) if you think otherwise. What you propose is band planning by mob rule, nothing else.

And after you squander the remainder of 420-450, I am sure you will be hot on our signals to push us off 900

or 1240. How much activity on ATV during the day of my band scan? There are 3 ATV repeaters in Chicago. There are over 40 local active users. On just about any night there are 6-10 users on in various areas using simplex or the repeaters. There will be more activity as soon as the in-band repeater completes it's move to an advantageous site.

We has had 12 users on one repeater at the same time and Chicago is a low activity area. The big gunds, N9AB, W9ZIH operate DX regularly and there is a net on Thursdays. I just moved and as soon as I get may array back up my 1 megawatt ERP will join the activity.

Does it make sense to move your 109 links for ATV? Depends. If the links are low power and point to point, and are not interfering with other band users leave them. If they are causing interference, move them. But you decide, WITH THE OTHER BAND USERS, not by yourself. That's the point.

On the other hand, what justifies your unilateral decison to move existing ATV operations that are vastly more expensive to move than FM links. Links are cheaply made from junk Motorola gear, change a couple of crystals, big deal. I know, I've owned some. Try moving an ATV repeater. First, likely no frequency in the band to move to. That means new antennas, new transmitter or receiver, new filters, before you know it \$5,000 easy. Want to pay for that move?

FM and ATV are not the same in use or technical parameters. FM can much more easily move to 900 or 1250 than ATV. There are no commercial amps for ATV at these frequencies. High absorbtion losses, coax losses and no power = no range. Not so FM. You can get 10 watt or higher FM rigs, portable, mobile and base for 1200. Plunk your money down and start talking. ATV? back to 2C39 amps or very expensive home brew with class A solid state devices.

I have yet to hear any FM'er offer exclusive use ATV frequencies on any other band. Excpet for those areas with mountains and desert, 900/1200 doesn't hold much use for ATV. We flat landers have hills only big enough to slow a VW and the few tall buildings are already occupied by QRM causing FM mode systems.

That's why it is unreasonable to ask ATV to leave 440 (among other reasons). The QRM from 50 megawatt radar units rips up our video on 1250, but you don't even hear it on your FM rig. So which mode

better shares 1250 with radar? FM!

900 MHz? Fight it out with the Lo-Jack people. A couple of 1 watt ATV rigs are available, and you can us a 15 watt brick for rotten linearity, and get about 8 watts of video. Are you getting the picture yet? We are not interested in moving! Henry KB9FO

ANNOUNCEMENT ATV LIST MOVING

From: ELT@en.irony.com (Ed Taychert)

Hello all ATV@irony.com subscribers. The atv@irony.com mailing list will be combined with the ham-atv@csd.edu mailing list. The combined mailing list will be hosted by ham-atv@csd.edu. I believe that the united mailing list will better serve everyone interested in amateur television. Members of the ATV@irony.com mailing list will automatically be subscribed to the ham-atv list. You don't need to do anything other than start addressing your ATV related mail to ham atv@csd.edu.

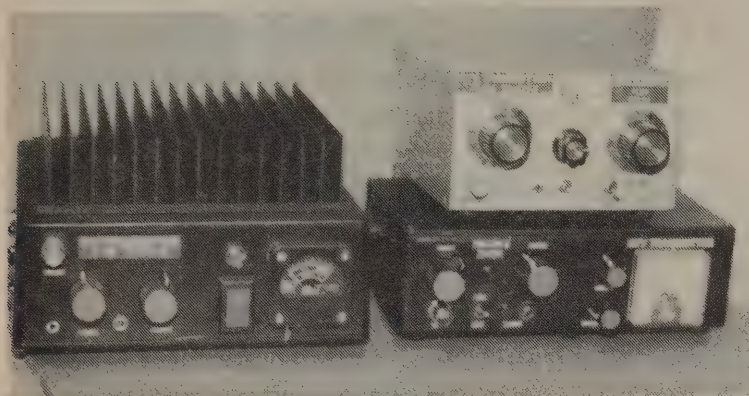
The old mailing list will keep running for a few days more in case you have some problems or questions about the new list. I'll be happy to help you with any that you might have. There are some differences in the list servers that I'm aware of:

1) The default when you reply to a mail note from atv@ironycom is to send the reply only to the author of the note. To send a reply to everyone ont he list you have to use the reply to all feature. The default whenb you reply to a mail note form hamatv@csd.edu is to send the reply only to the author of the mail note. To send a reply to everyone on the hamatv list, you must use your mailer's "reply to all" feature or explicitly add hamatv@csd.edu to the "to:" line.

2) For the few digest mode subscribers, there doesn't seem to be a digest mode for the hamatv list. You'll have to get the list mail as it is received instead of the once a day batches. To get more information on the mailing list list server at uscd.edu you can send mail to listserve@csd.edu with the message "help". I'd like to personally thank everybody for using atv@irony.com and I look forward to seeing you on the ham atv@csd.edu list. 73 Ed AA2MZ

ATV TRANSMITTERS & TRANSCEIVERS

70 CM AM Video 10W P.E.P.....	\$293.00	1 XTAL PD-ATV-5
70 CM AM Video 55W P.E.P.....	\$530.00	1 XTAL PD-ATV-50
70 CM AM Video 10W P.E.P., w/tunable Down Converter...	\$395.00	1 XTAL PD-ATV-4



33 & 23 CM Transmitters - F.M.

Tested Completed Boards 20-50 MW outputs
\$170.00 & \$180.00

F.M. Power Amps for above:

PD-900N-6, 8-10W output.....	\$159.00
PD-900N-7, 20-24W output.....	\$229.00

POWER AMPS LINEAR 70 CM

PD-440N 0.5-5W IN=18 out T/R.....	\$129.00
PD-440N-1 0.5-5W IN=35 out, T/R.....	\$149.00
PD-440N-2R 4W=55W No T/R.....	\$199.00
PD-440N-2 0.5W=50W, T/R.....	\$285.00
PD-440N-3 3-4W=50W, T/R.....	\$225.00

Linear 33 CM

PD-33 VLP-1 1 MW=6W.....	\$115.00
PD-33 LP 1/2-1W=6-7W.....	\$135.00
PD-33 HP 6W=18W.....	\$149.00
PD-33 LHP 1W=18W.....	\$265.00
PD-33 LHP 1W=16W, T/R.....	\$305.00

F.M. 33 CM

PD-900N 1W=8-10W.....	\$ 65.00
PD-900N-1 1W=20-24W.....	\$143.00

POWER AMPLIFIERS

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HF VHF UHF

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FOUR CHANNEL

70 CM CATV Video Driver, 1 MW Transmitter
including 6W output, linear P.A.

PD-440NA.....	\$250.00
Freq.: 421.25 - 433.25 - 427.25 - 439.25	

BRICKS & BRICKS ON BOARDS
Call for quote. LOW PRICES!

ATV BOARDS 10 W P.E.P.

70 CM (AM), tested.....	\$200.00
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VIDEO SAMPLERS — \$72.00 and \$92.00

Video output and R.F. out for CH 3-4 (TV)

PDVD-1 and PD-VD-1A

P.A. 1.2 Ghz. Lin.

PD-1200N 1W=18W.....	169.00
PD-1200N-1 3W=36W.....	305.00
PD-1200N-1A 1W=36W.....	375.00
PD-1200N-2 1W=16W, T/R.....	214.00
PD-1200N-4 3W=32W, T/R.....	385.00
PD-1200N-5 10MW=18W.....	295.00

PREAMPS

70 CM - 33 CM - 23 CM

N.F. less than 0.5 db G=14-23 db....	\$70.00 - 450.00
Some tuned input and output, 2.4 Ghz. N.F. 0.7 db	
G=18 db.....	\$139.00

DUPLEXERS 2 Mtrs. - 70 CM DOWN CONVERTERS

70 CM and 33 CM, tunable

\$69.00, \$75.00, \$85.00, \$88.00, \$90.00, & \$92.00
2.4 Ghz. down converters please inquire.

pauldon
ASSOCIATES

We have similar problems here.

From: midshires@cix.compulink.co.uk (Andrew Emmerson)

There's a pan-European initiative by governments to harmonize amateur freq. allocations across Europe and one proposal is to cut 70cm band back to about 6MHz total. In most countries amateur radio is at least primary user, In Britain not even that. Inevitable conclusion is that ATV must get off 70cm or go narrow band. But actually that may be no bad thing. I'm not desperately in favor of very narrow band VSB AM, although a 1MHz-wide signal would get through the DX just as well as a wider band one. But if it stimulates ATVers into going digital and adapting/adopting MPEG2 techniques, then we could possibly have ATV any place, any time anywhere as the slogan goes. It would raise the profile of ATV far above packet and all other ham modes. In fact I'd even go so far as to say, if the ATVers can't be bothered, they don't deserve to keep their ATV privileges. But I don't expect many other hams would share my viewpoint. But they must admit that playing around with the same techniques that hams were using back in the 1940s is scarcely the cutting edge or 'self training in the art of radio communication'.

I'M IN FAVOR OF ATV

From: Rapper25

Dear Mr. Ruh:

I received your letter today, as I have been away for some time. Obviously, I did not receive your letter before your deadline for a response to the recent MACC coordinators meeting. I hope that you will receive this note via AOL in time. I will keep my response brief and to the point. I believe Mr. Brown's comments explain the situation a little better than the minutes of the MACC meeting. I do not believe that simply from the minutes can the spirit of the decision be understood. I certainly have no objection to ATV.

In fact, I am very interested in pursuing some ATV operation in the near future, and I currently have family and friends running ATV at this time. However, since AMSAT is restricted by law, not coordination, to operating in this particular segment of the 70cm band, I can't see a good way out of this situation for any side. Each of the coordinating bodies in MACC will be

discussing this decision. I have already had some discussion with some people here in Indiana. I know that ANY decision will be unpopular with some group. I believe, at least at this point in time, that the decision that was made was the best that could be done. If you have an answer that will satisfy everyone, I would be most happy to review it and if appropriate, act upon it. I might also remind you that MACC does not have the ability to "outlaw" anything. Your letter stated that we tried to "outlaw ATV on the 70 cm band." That job lies with no one but the FCC. As coordinators, it is our job to plan the best we can to minimize interference while dealing with facts and laws that we must abide by, not simply issues. I look forward to hearing your input as to how we can solve this issue for all parties involved. Neil Rapp WB9VPG

Homebrew ATV antenna question

From: fkf1@cornell.edu (F. Kevin Feeney)

I'm looking for suggestions on simple but effective antennas for 430 MHz ATV. The equipment (which arrived yesterday) consists of the PC Electronics downconverter, exciter and 10 watt amp feeding a 100 watt Mirage amp. I have a 8-foot 11-element quagi almost ready to go. Any better ideas? Does stacking antennas reduce bandwidth too much?

I've used Quagis with good success, and helixes also. The quagi's seem to have more bandwidth than a yagi with the same element count, and the matching seems much less critical. I usually tune them for the video carrier frequency or a little higher. They don't seem to be sharp enough, at least over the paths that I use, to clip the colorburst too much. I think that some yagis have been known to do that. The helix is even more broadbanded (mine is flat from 420-450) and can be used with stations receiving on both UHF vertical (FM) antennas and horizontal (TV LPA's pressed into service) equally well. They are very tolerant of dimensioning with the exception of the last turn towards the base with the radial 50 ohm matching technique. But once you get it right, it's wonderful.

I've been using one for AO13 for 5 years that has 14dbd of gain to single polarization. It's 14 turns on a 10 inch diameter with 8 inches per turn. Ten foot long overall, made with 1x2's and copper tubing. It's good for satellites, atv, fm, and weak signal ssb, plus it's not bad on some of the uhf channels :-)

73 de Kevin, WB2EMS

900 MHz FM Rabbit Receivers

From: billwest@hookup.net (Bill Westbrook)

Permit me to introduce myself and provide a little background. I am a retired telco engineer, heading up a group of eight hams dedicated to establishing the first ATV repeater in the Ottawa area. Members of the Video Repeater Committee were elated on a recent Saturday afternoon. After three years of planning they finally had an erection. That's right, the ATV antennas are installed at CJOH-TV on Merivale Road. Using a 50 ton crane, with a 150 foot boom, the three antenna arrays were lifted into place. Charlie Ross, the president of Ottawa Crane Rentals performed his famous 'humming bird' imitation by riding the ball to detach the nylon sling that held the 2.5" mast supporting the 900 MHz transmit and the 1,200 Mhz FM receive antennas while it was being inserted in the top of the 4 inch diameter mast used to support the 439.25 MHz AM receive antenna.

I would like some info on FM Rabbit Receivers. I understand from reading ATVQ that the Atlanta group are using HTS 900 MHz FM Rabbits. Could someone please supply the following information?:

1) Manufacturer 2) Model Number 3) Source 4) Specs 5) Cost 6) Do they sell the Rx separately? 7) Will there be a vendor at Dayton with HTS equipment? Perhaps you could provide an e-mail address for one of the Atlanta ATV group. 73 Bill Westbrook, VE3EKA

SCROLLING MESSAGES

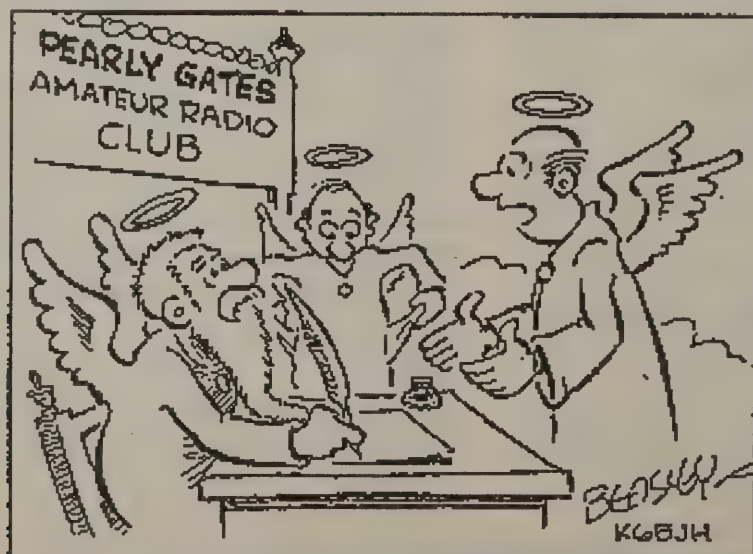
From: doug.ferrell@exchange.tlh.fl.us
Hello fellow ATV'ers!

I have been looking around for a program for quite some time that would "scroll" messages across your monitor like the TV stations do. Since I do not have a video camera at the moment, I have found this an excellent way to get your call and messages on tape. Many years ago I had a program for the old Radio Shack Model III (that is in my garage collecting spiders!) that would simply scroll text from bottom to top in 2 inch letters for attracting "customers" to the counter or window display in a store front (or something like that).

In my search through all of my CD-ROM's, I came up with a program called AutoMessage 2.0 that seems to "fit the bill". It allows a top of screen header, bottom of screen header and scrolling text. You can even change colors, fonts and even sound (in the registered version).

I have AutoMessage working with a cheap VGA to composite converter so that I'm able to transfer the messages from the computer's VGA port to video tape or monitor. Although I was not deeply impressed with the video quality (not exactly like TV production graphics) on the monitor compared to my Super VGA display, I realize that for the money invested, it cannot be beat! I'll keep you posted on my progress.

I am still playing around with AutoMessage, but I thought I would share it with you folks that might be in the search for this kind of program. Doug
KD4MOJ



NO, I DIDN'T BRING MY AMATEUR RADIO OPER-
ATOR'S LICENSE--- THEY ALWAYS TOLD ME I
COULDN'T TAKE IT WITH ME

THE DUAL BAND MAG WHEEL FOR MOBILE ATV

from Olde Antenna Lab
Dave Clingerman - W6OAL

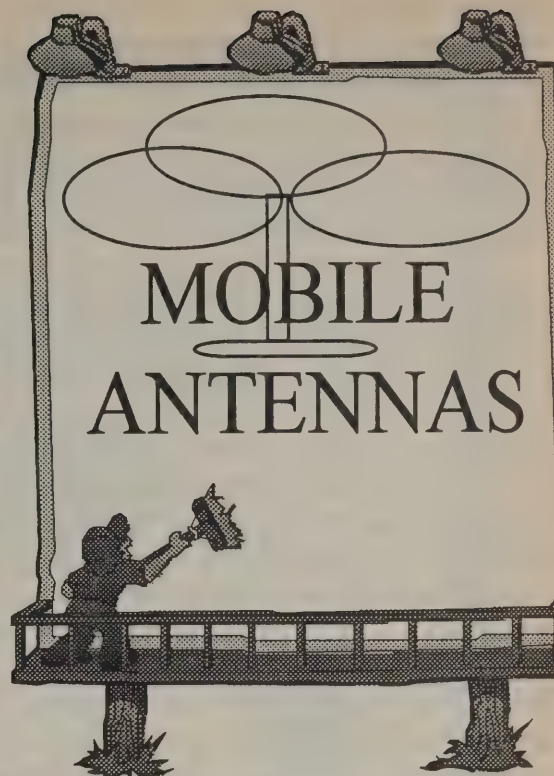
From the cards and letters we receive at O A L people are asking and wondering as of late 'what's new'? Well, considerable when it comes right down to it. Antennas for 222 MHz, a Folded Halo for the 2 meter band, Radomes for the 33 cm, 23 cm, 13 cm Quad Wheel arrays and Dual Band MagWheels. Business is just business away and the consideration given me be the HAM community is very much appreciated. We continue to provide the new products that have been requested. The Quad LittleWheels (70 cm) for repeater operation are continually being sought after and the Quad NanoWheel (33 cm) array with Radome has been a hot number among the 'wireless LAN' suppliers.

Recently there have been questions concerning the feasibility of creating a dual band wheel array and then, how well will it perform? Being a one man operation, when I'm manufacturing, research goes on stand-by and vice versa. However, the manufacturing is what brings in the money, and that's our number one priority. The Thanksgiving Holidays did afford me a little time to work up a design for a dual band wheel array, build a prototype, and engaged it in a multitude of testing. Some of the decisions that go into a product like this are; what band combinations are possible, should a single or dual transmission line be employed, if a single feed line is used should a duplexer or switch be employed, what sort of spacing between wheels will be needed to curb interaction, if it's to be a MagWheel type of mount what is the wind loading at 85 or 90 MPH, how can a pair of transmission lines be stabilized in a dynamic environment, if there is feed line radiation from one wheel will it affect the other one? If a choke need be employed will it effect the wind load and by how much? All of these things have to be investigated, problems addressed and solutions arrived at. These things take time, and time away from manufacturing means less toys under the tree.

The experimentation process for the Dual Band MagWheel went into action with a jolt as the latest Quad with Radome went out the door. We decided that the most common combination would be 70 cm/23 cm. We also decided that a series of duplexers is not what we

want to do right now. Therefore, a dual transmission line system was decided on. We started with a couple 19" length of 0.250" Dia. Micro-Coax hardline. The 23 cm Wheel (MiniWheel) was built on one of the lengths and resonated that the VSWR was relatively flat from 1250 MHz to 1300 MHz. The second length was fitted with a 70 cm Little Wheel and resonated to cover the top ATV frequency (439.25 MHz about 10 MHz). The MiniWheel and coax was positioned and in parallel with the coax of the Little Wheel, about an inch apart and loosely taped in place. Some temporary type "N" coax fittings were affixed to the input ends of the transmission lines. The 23 cm wheel was set up first on the sweeper-VSWR Bridge -O'scope combination. When the Mini Wheel was moved to within a quarter wavelength of Little Wheel the point of resonance began to change. Sweeping the Little Wheel gave the same indications, so a ferrite beads were slipped over the 23 cm coax and position just below the Mini-Wheel. Sweeping both wheels and staying no closer than a quarter wave length at 23 cm cause no resonance shifts.

The ferrite beads worked fine, however, trying to keep them in place was going to be more bother than I wanted to endure. A 23 cm quarterwave shorted sleeve was constructed and placed over the MiniWheel coax. It was positioned within a tenth of an inch of the hub of the bottom wheel elements and soldered to the coax at the shorted end. The mouth of the choke was fitted with a Teflon bushing and sealed in place with



Silicon Rubber Compound, General Electric RTV-108. When both wheels were swept to confirm that there was no interaction. The 23 cm wheel would be the top wheel for a reason. Beneath a LittleWheel it would be in the shadow area since from a vehicle roof the look angle is generally going to be up from the horizon. And, one more thing that was employed in the early stages of construction.

The two wheels were constructed of opposite polarity to each other in an effort to minimize interaction. With this, the biggest of the problems out of the way, the mechanical integrity problem was undertaken.

The single run of 0.250" hardline sporting a Little Wheel seems to stand up fairly well at highway speeds of 85 MPH. But, how about a pair of them. We turned the crank on the equations for surface area and wind loading and torque at the attachment point to the magnet. All seemed to fall within design and stability parameters. As a matter of fact, the magnets we buy from Lakeview Co. Inc. will hold on to a metal surface long after the hardline has been laid against the roof of the vehicle. This would be somewhere around 165 MPH if it were to be tried. The magnet can be jared loose like me having to take a ditch now and then during the Colorado winters. This is in an effort to keep from being hit by the 'cowboys' coming sideways at me in their "4X4's".

The two hardlines could be on the order of an inch apart without any electrical or mechanical interference. I thought of using Teflon but then thought better of it as it's rather slippery. I chose some 3/4 inch plugs of 3/4 inch diameter Nylon. One quarter inch notches were filed into the sides 180 degrees apart. Each notch was about an eighth to 3/16 inch deep. The plugs were then held in place with small hose clamps. I positioned them about a foot apart on the two transmission lines.

The two input ends of the hardline were cut even and bent to 90 degrees leaving a one inch stub length to be fitted to the bulkhead mount type "N" female coax connectors. The hardlines had to be spread sideways a little to mate with the coax fittings that were affixed to an "L" bracket. The "L" bracket is then fitted to the magnet with appropriate hardware.

The top antenna the MiniWheel (23 cm), on the finished product will ride about 17 inches above the vehicle roof, with the Little Wheel (70 cm) about 3 or 4 inches below it. The choke is made of one half inch diameter copper pipe and an end cap which has very little effect on the wind loading. The bare brass and copper colors of the array are not unpleasant to look at, however; even the most beautiful antennas are sometimes not fully 'wife approved' so I scuff the surfaces and paint the MagWheels using an

'epoxy' flat black. Out for a drive, the array was set in the middle of the roof of my Plymouth Van and off we went to a major highway. The wind was blowing pretty good from all directions as it usually does around the foothills of the Front Range of the Rocky mountains.

I selected a stretch of highway that I knew would be fairly straight for quite a ways and started my run. There were very few cars and no police in sight so I got up to where my speedometer goes 'bump' some where past where the numbers stop at '85'. Nothing fell off or came loose. I made an equally quick sprint in the other direction back to where I'd started and still everything held on just fine. Once back in the 'lab' I measured to see if there had been any bending of the coax as I'd purposely arranged the mounting so wind would hit both coaxes head on. If there was any displacement out of the vertical, I sure couldn't measure it with my caliper and square.

I think I've covered everything necessary to construct a Dual Band MagWheel in case anyone wishes to take on such a project. Let me advise on the cost that could be incurred on materials;

Brass rod for wheel elements	\$3.00
Brass machined hubs	\$5.00
Brass sheet for stubs	\$2.00
Teflon sheet for insulators	\$5.00
Copper pipe and cap - choke -	\$5.00
Magnet	\$10.00
Hard line, 0.25", 50 ohm	\$23.00/ft
Type "N" bulkhead connectors	\$30.00
Machined "L" bracket mount	\$5.00
Misc. hardware	\$5.00
Paint	\$4.00
total:	\$109.00

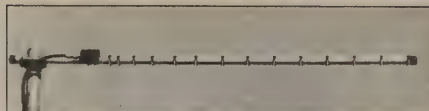
Plus quite a few thousand dollars worth of test equipment so you can tell where you are and what you're doing to any sort of accuracy (the right way), not to mention the cost of manufacturing machinery (breaks, sheers, drill press, band saw, vertical sander, grinder etc. OR, I will be glad to create a (70/33), (70/23), (70/13), (33/23), (33/13), (23/13) Dual MagWheel for you for the surprisingly low introductory price of \$124.95 - get 'um while they're hot or more to the point while I'm in the mood to build them. WARNING: please do not operate ATV Mobile while you are in motion. This sort of action is not conducive to longevity. Let your passenger do the operating. In this day and age driving is a full time job when you are on the road. Do your best to out live your subscription to ATVQ. 73, Dave - W6OAL

COMET

ANTENNAS FOR THE PROFESSIONAL AMATEUR

CYA-1216E

16 Element Yagi Beam 1260-1300MHz
Gain: 16.6dBi
VSWR: 1.5:1 or less
Impedance: 50 ohms
Max. Power: 100 watts
Polarization: Vertical or Horizontal
Length: 4' 5"
Weight: 7 lbs. 11 ozs.
Mounting Mast Diameter: 1 1/2" x 2 1/2"
Connector: N-type
Construction: All Aluminum

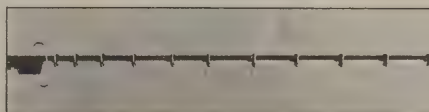


CA-1221S

Mono Band
1260-1300MHz
Base/Repeater Antenna
1/2 Wave 21 Step
Collinear
Gain: 15.5dB
Impedance: 50 ohms
VSWR: 1.5:1 or less
Max. Power: 100 watts
Length: 8' 6"
Weight: 2 lbs. 3 ozs.
Mounting Mast Diameter:
1 1/4"-2 1/2" inches
Connector: N-type

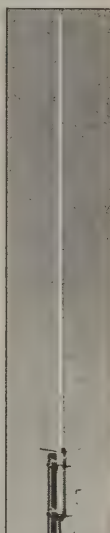
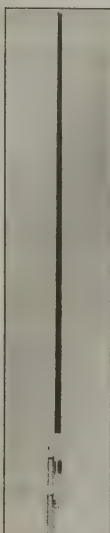
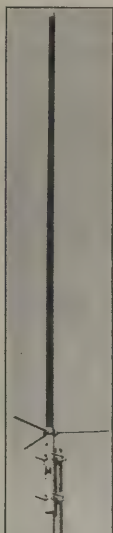
PYA-913

Base 13 Element Yagi
904-920 MHz
Gain: 15.8dBi F/B ratio
over 20dB
Max. Power: 150 watts
VSWR: 1.5:1 or less
Length: 4' 3"
Connector: N-type
Construction: Aluminum



CA-1243Z

Dual Band
440-450MHz
1250-1300MHz
Base/Repeater Antenna
5/8 Wave x 4 446MHz
5/8 Wave x 9 1200MHz
Gain: 446 9.4dB
1200 12.8dB
Impedance: 50 ohms
VSWR: 1.5:1 or less
Max. Power: 446 150 watts
1200 50 watts
Length: 7' 5"
Weight: 2 lbs. 8 ozs.
Connector: N-type
Construction: Heavy Duty
Fiberglass



FP-19

Base/Repeater
905-925MHz
Gain: 16dBi
Impedance: 50 ohms
VSWR: 1.2:1 or less
Max. Power: 100 watts
Length: 7' 4"
Connector: N-type
Construction: Heavy Duty
Fiberglass

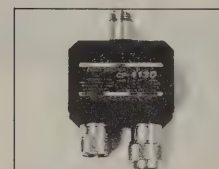
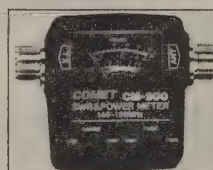
CF-4130 446/1200MHz

dB Loss: 1.3-460MHz 0.2dB
900-1400MHz 0.3dB
Band Rejection: 55dB Down
Max. Power: 146MHz 800W PEP
446MHz 500W PEP
1200MHz 200W PEP
Connectors: N-type

MINI SWR

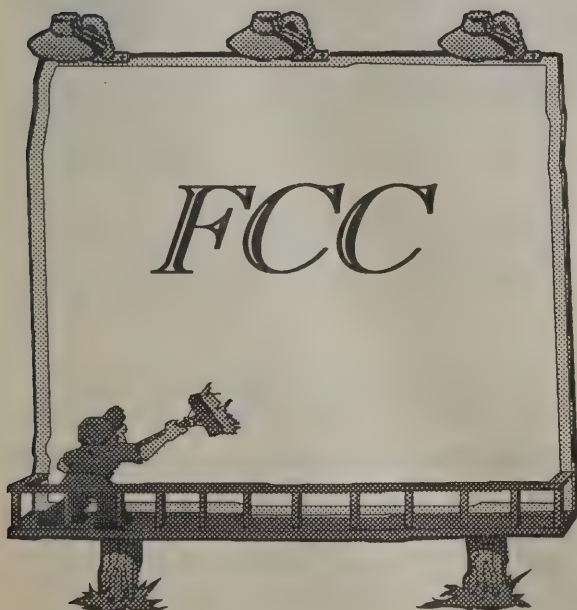
Power Meters
Max. Power Loss
CM-200 140-150MHz 45 watts 0.1dB
CM-300 200-240MHz 60 watts 0.2dB
CM-400 420-460MHz 50 watts 0.2dB
CM-420 140-460MHz 50 watts 0.1-0.2dB
CM-900 840-950MHz 60 watts 0.2dB
CM-1200 1225-1325MHz 60 watts 0.25dB

Measurements: 2.25" w x 2.25" h x 1.1" d
Weight: 5.25 oz.
CM-200, 300 and 400 have SO 239 Connectors
CM-420, 900 & 1200 have N Connectors



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CALL FOR THE DEALER NEAREST YOU!



Subject: FCC database on Internet
From: tom.hammond@WOODYBBS.COM (Tom Hammond)
Greetings... thought many would enjoy reading this.
This is NOT an April Fool's joke! Enjoy. 73 - Tom Hammond
NOSS

Effective immediately the public can access the complete amateur database on the Internet via the FCC's ftp site. The database will be updated every Monday by noon and daily updates will be posted on a five workday cycle. Anyone having access to the internet can retrieve information from the amateur database using the following procedure:

Access: anonymous ftp fcc.gov

Directory: pub/xfs_alphatest/amateur

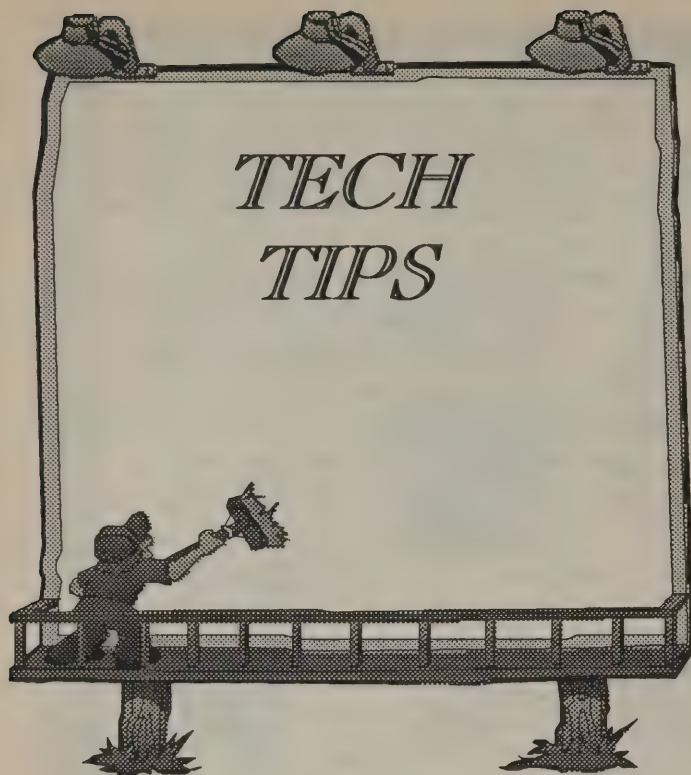
files: full database: amateur.zip (32Mb ZIPped/144Mb unZIPped) daily updates: mon.zip — tue.zip

| Daily file sizes run between wed.zip

| — 2.4kB-34kB ZIPped and thu.zip

| 3.9kB-81kB unZIPped fri.zip — documentation: readme.txt

Any questions: Contact FCC Consumer Assistance at their regular numbers. • LAKOTA v1.4 — Alexi/Mail 2.02b (#83) • Origin: Distant Winds BBS • USR 28.8 DS • [314] 635-7868 (1:289/67)



SPACE SHUTTLE

From: thomas_carter@logitech.com

Howdy fellow ATVers: I'm getting everything ready on my end for shuttle broadcast ... so I'm wondering what the latest is on the next launch. I had read it was supposed to be around June 9th but the paper today said that it's in late June (no date specified). Anyone know? ...DOUG

Doug, just subscribe to the NASA internet press releases. This way you can get emails daily describing what NASA is doing. Included are complete space shuttle schedules for current and future launches. If a launch is delayed, you get up to date info explaining why, etc. Here is the paragraph they send at the end of each e-mail describing how to join: NASA press releases and other information are available automatically by sending an Internet electronic mail message to domo@hq.nasa.gov. In the body of the message (not the subject line) users should type the words "subscribe press-release" (no quotes). The system will reply with a confirmation via E-mail of each subscription. A second automatic message will include additional information on the service. Questions should be directed to 202-358-4043. Tom Carter C6TNB

Adding a 100 watt ATV amp

Bill Moore, N3HEX, asked me a fairly common question that I thought I would pass on to the net. He has a 10 watt transceiver and is thinking of adding a 100 watt amp. He asks if you really need to do the power and pedestal set up, and if you do, do you have to reset to go back to low power for close in work. Not everybody has a power meter handy in the shack capable of 100 watts full scale for the 440 band. Hopefully there is one or more in any give area and an owner who will stop by for a few minutes to make the set up.

It is definitely necessary and very difficult to do by blind tweaking or hit and hope. Just like SSB voice if you shout or crank up the mic gain too high with the alc off, you can splatter the band. Now, more than ever, we need to be good spectrum neighbors. Unlike FM or CW, over driving the amp will not only squash your sync, color burst and sound, but the intermod sidebands will be very strong and wide.

Set up is easy and just takes a few minutes with a small screw driver and power meter. The 100 watt amp must have it's own separate power supply because of the current varying at a video rate over any of the leads will get into any other equipment connected to it. With no video connected, turn the pedestal pot in the ATV exciter/modulator to its maximum power position. Make sure the amp is connected to a good 50 ohm dummy load or low vswr antenna (less than 10% reflected). Turn on the amp and transmitter and quickly set the RF power pot on the exciter/modulator to no more than 90 watts, not 100, you need some headroom for the sound that rides on the sync.

Then set the blanking pedestal pot for 50 to 55 watts. Plug the camera back in and have a distant station on two meters talk your video gain in to just before white clipping or smearing. That's it. Your peak envelope power on sync tip will be the 90 watts regardless of what the power meter reads. Now what happens when you turn the amp off for close in stations? Depending on the gain curve of your particular amp, you will have more sync than normal and the picture will seem to have less contrast. This may or may not be a big deal depending on the individual. Don't be tempted to crank up the video gain to compensate, you will just end up splattering the band - never get into white smearing. 73, W6ORGy

ATV BOOKS

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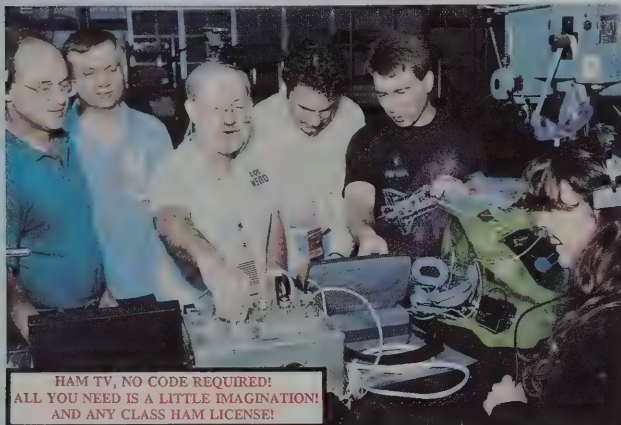
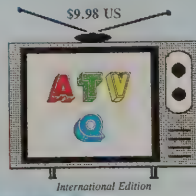
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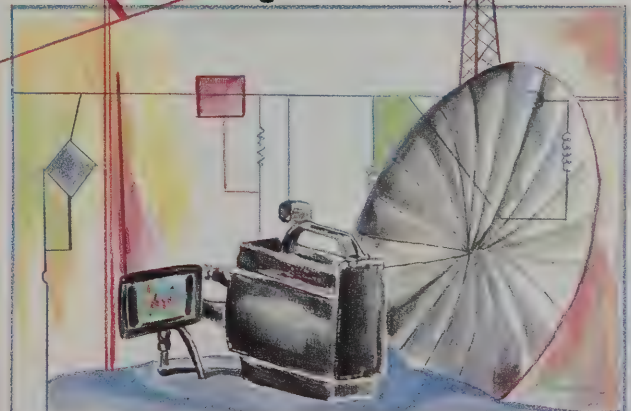
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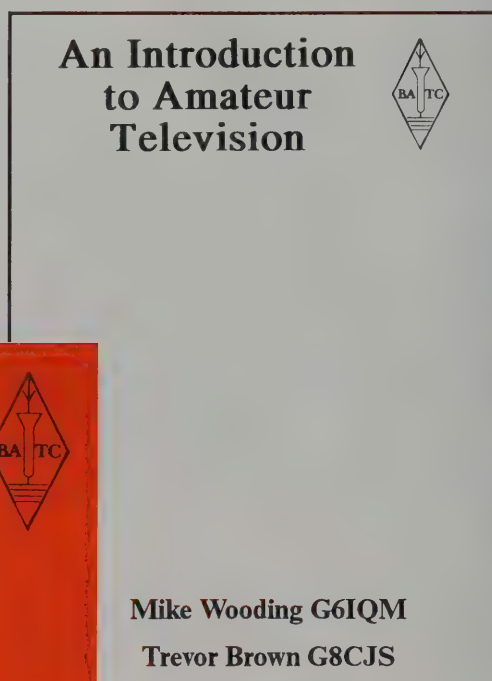
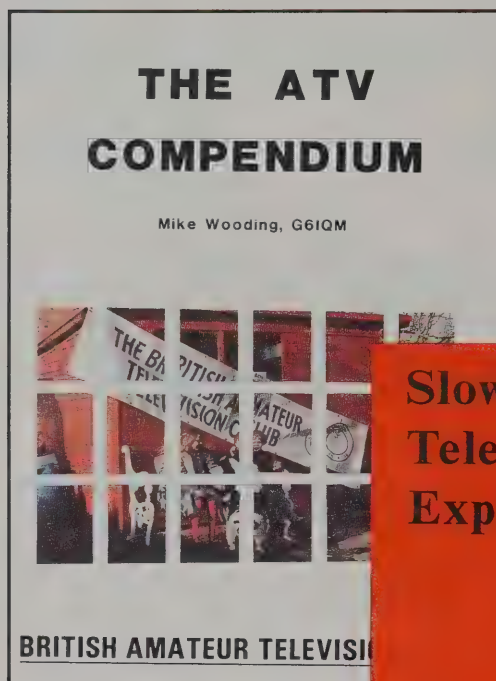
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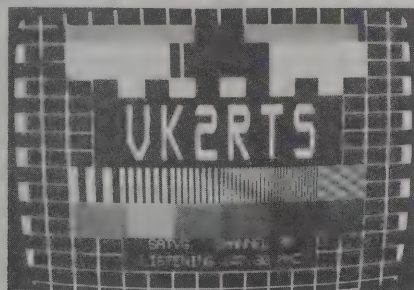
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VOLUME 6 #1
JAN., FEB., MARCH 1993

ISSN 1042-198X
USPS 003-353

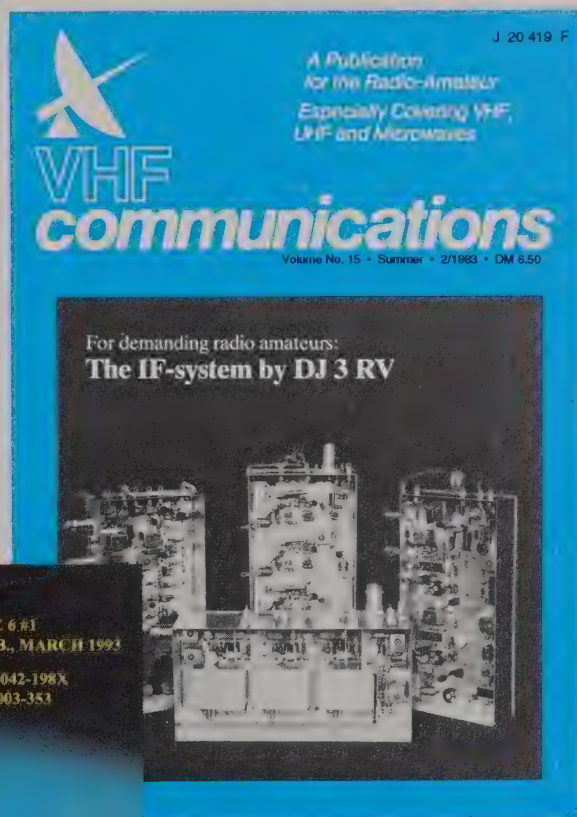
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STUDENTS REPORT ON THEIR WORLD

Richard Paolinelli

The TV camera operator is in position. The announcer opens the news broadcast. Anchor Elaine Bettencourt introduces herself and starts the broadcast with the day's top story. The latest from Bosnia? The selection of a Supreme Court Justice nominee? No; this weekly broadcast begins at 6:00 p.m. Monday with the latest happenings at Chatom School as reported by students in Brooks Rushing's science class. The class broadcasts a 10-20 minute show from Chatom via the call sign KD61SC on amateur television. Stories are generated from their school and ham radio experiences about the campus west of Turlock. Three of the students have their ham radio licenses and eight others are studying for theirs.

"It's a two part test," Bettencourt explained. "You have to pass both parts and it's very hard to do." Behind all the whole "Broadcast News" experience is a 34 year teaching veteran, Rushing. He spent more than a thousand dollars of his own money, and none of the school's, to set up the video camera, monitors and antennas to get in-class studio off the ground. Has it been a sound investment? "Oh yes, it has really been worth it." Rushing said. "The kids are seeing a lot of opportunities that they would not have seen otherwise." "In another year or so," Rushing added, "I see this being in a lot of schools everywhere. This is the coming thing." Rushing, who teaches science and computers, never thought he'd be a part of such a broadcast. "After I became a ham operator, I saw the opportunity to get involved in amateur TV with the kids," he said. Some of Rushing's graduates still return to the small school studio. "Whenever I come here, I give a report on my experiences at the high school." said Victoria Silveira, a student at Turlock High who attended Chatom and Rushing's class last year. On this night licensed ham radio operator Silveira gives a report on two medals she recently won in a regional and state vocational club leadership competition. Then another licensed student, Jason McCurry, gives a report on recent school field trips and previews those to come.

The live broadcast is watched by up to eight other amateur TV operators in the Valley with television broadcasting equipment. Those eight can participate in the broadcast, asking questions of the students after the last reports. Other Valley residents with regular televisions might be able to view the show. To find out, simply disconnect your cable from your cable box (not the TV) and turn the set to channel 58. If you see the call letters on the screen, you're tuned in for their broadcast. The Chatom class can also communicate visually with schools in Fresno and Riverbank. They transmit stories over the air about their school and receive similar stories from the other schools. The experience has also given the students a new perspective on other

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news broadcasts. They watch the broadcasts with a critical eye, spotting an incorrect camera angle or miscue and seeing how they would have done it differently. As for a career choice in broadcast journalism, no one is really Considering becoming the next Dan Rather or Connie Chung yet. "I know I want to go into communications," Silveira said of her career plans, adding "I just don't know what field yet."

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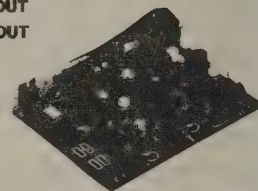
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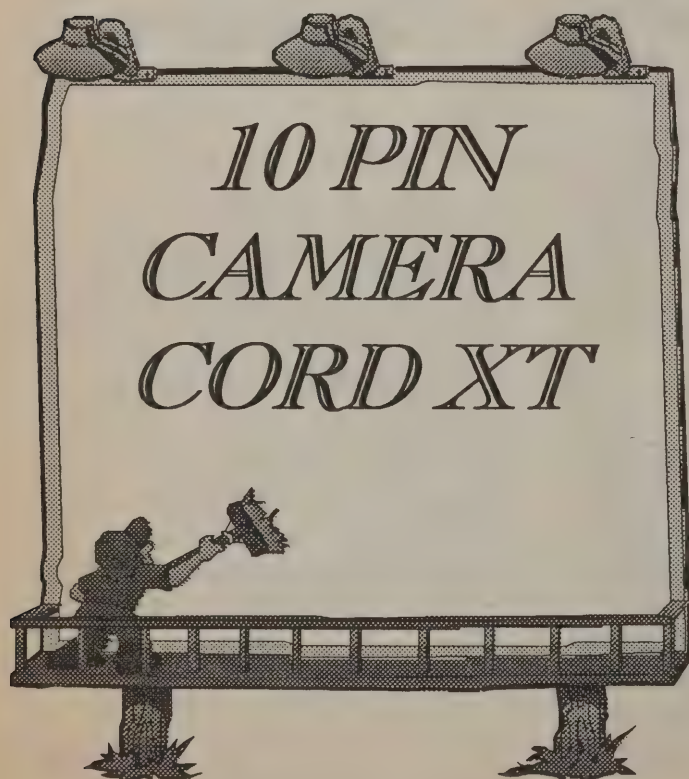
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From: lazeraud@sentex.net

Looking for an extension cable for your camera?
I got one quite a few years ago from my RCA dealer.
Wasn't cheap, but sure beats trying to make one on your
own! The one I got is 25 ft long and works great (I have
the camera on one of the small towers near the house to
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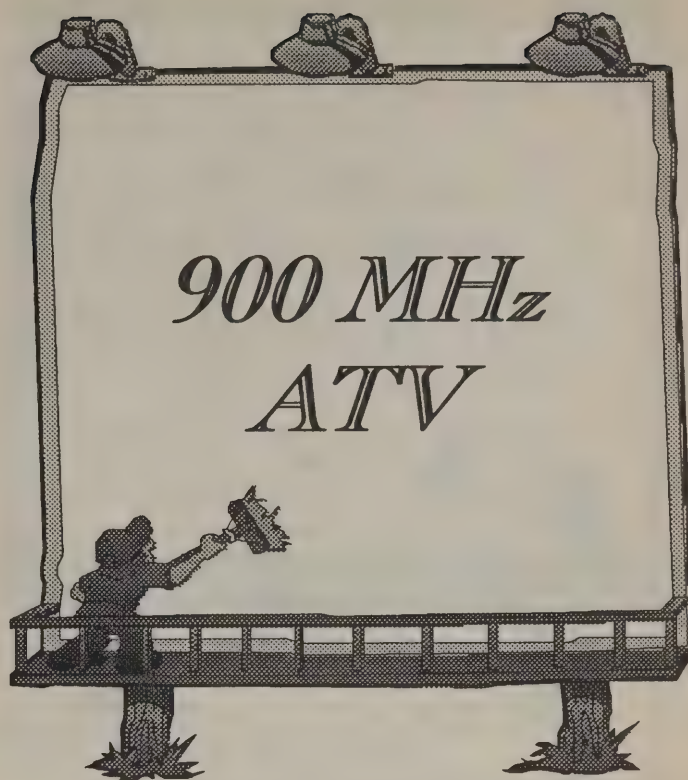
900 MHz FM RECEIVERS

From: billwest@hookup.net

Have just got our ATV Repeater on the air. Now the problem is how do we get people to use it? It seems to me that if we had a source of inexpensive receivers that would let interested hams try to receive the repeater to see if they want to invest in ATV gear it would be useful. Any suggestions? What about FM Rabbits? Anyone had success at converting AM units. Downconverters and Satellite Receivers? Cheers! billwest@hookup.net (Bill Westbrook) Orleans, Ontario, (near Ottawa) Canada "Egotist. A person more interested in himself than me".

From: billwest@hookup.net

My first question HAS to be HOW Cheap? The idea of sat. Rx with a down converter has got to be a winner. Here in the UK we can buy an Astra 1D Sat D/C (knocks off 500MHz) for around 15 UK pounds. They have about unity gain but with the mods we usually do to the Sat Rx they are no problem. I too am involved in an ATV repeater. GB3VX. We will operate at 1249MHz in and 1316MHz out, 16MHz B/W, 6.0MHz IC sound form a pair of Alford slots as soon as our NOV arrives. We have had great results from some of the lowest grade Sat Rx with simple GasFet preamps in line. How about bringing me up to speed on the spec. there in the US. Thanks for your prompt reply. 15 quid sounds like the right ballpark for price. Do you think your source for the Astra D/C would ship to Canada? Can we get specs on these units? Details on your mods would be appreciated. Our repeater VE3ATV, has an input on 439.25 AM Mhz and 914 FM MHz out with 10 MHz B/W. We plan to add a FM input in the 1200 band at a later date When we compare AM ATV with FM over the same path we can see why you folks use FM systems. Your NOV, I assume, is approval from the authorities to operate a station. Looking forward to your reply. Cheers



Subj: RE: 900 MHZ FM RECEIVERS

From: tomsmb@aol.com

Now you know why most ATV repeaters are AM - everybody has a TV set. For 420-450 they can use a cable ready TV set to cable ch 57-60 to see their first picture. For 900 they can use a "rabbit" downconverter - Radio Shack \$60. But for FM they have to modify something for the basic receiver and still add a downconverter plus a preamp to get enough system gain. They can buy it all but that is some what expensive. 73 Tom W6ORG



RESPONSE

I don't think I can answer your question without writing a book. While the question of interference to/from various modes is simple, the answers are much more complex. First you have to understand the technical parameters of both modes. This includes interference susceptibility or immunity, transmitter and receiver specifications, spectrum analysis and much more. I am enclosing a current issue of ATVQ. Reprints and an index are available from Ralph Wilson, 4011 Clearview Dr., Cedar Falls, IA 50613. I will be long winded here. Let me try and be simplistic without going into mathematical detail.

AM vs FM modulation.

FM modulation (narrowband voice) is a "robust" signal. The carrier level is constant (except for Bessel nulls) regardless of the modulation applied. In addition, the sidebands are also constant within the deviation spectrum of the modulation bandwidth. In addition, as defined by Carson's rule: $2 \times \text{the deviation} + 2 \times \text{the modulation frequency}$, gives the total occupied bandwidth. For narrowband voice, the

figure is $2 \times 5 \text{ KHz}$ (if the transmitter has been adjusted for absolute maximum peak deviation of 5 KHz.....many are not) plus $2 \times 3 \text{ KHz}$ if we agree that voice modulation is limited to a maximum of 3 KHz as its highest frequency. Frequency tolerance and drift are often forgotten when considering channel spacing or spectrum space. So from "school" we would say that the FM signal is 16 KHz wide. The flat top portion on a spectrum analyzer of a 16K0F3A signal is 10 kHz wide and slopes down to the -26 dB occupied bandwidth definition at 16 kHz wide.

On a spectrum analyzer, speaking a loud FOUR in the mic would show 10 KHz of spectrum occupancy in a solid area, significant sideband energy sloping to -26 dB to 16 kHz and with the lesser sidebands tapering off into the noise. Measuring the occupied bandwidth of the FM signal at the -1 dB point (ie 1 dB below the "flat" top of the displayed signal) the signal should occupy 10 kHz. Now look at the tapered slope of the sidebands. IM products and the nature of FM modulation produces infinite sidebands.

MINNESOTA REPEATER COUNCIL

Member of Mid America Coordination Council

Repeater Frequency Coordinator Paul Emeott KOLAV 3960 Schuneman Rd., White Bear Lake, MN 55110, 612-429-5040

Jan 7, 1995

SUBJECT: ATV repeater receiver technical modifications for lower sideband operation

Dear Henry,

I am one of the persons who talked to you at the BOM in St. Charles, MO about what might be done to the repeater hardware of the ATV repeater in the Twin Cities area to allow the repeater receiver to better "live" with shared use (FM repeaters and packet) in the 438-444 Mhz area of the 440 Mhz band. I have talked to the technical committee members of the Minnesota Repeater Council (MRC) and they are willing to help the ATV repeater operator if we can get some idea of the methods that might be used to allow a single-sideband type (I believe that you described it as lower sideband operation) operation of the ATV repeater receiver.

Can you provide us any of the following ?

- 1) A list of articles in the ATV Quarterly or other ATV magazines or data that would explain this type of operation and how to change the equipment to have it operate in this mode.
- 2) A written description of what you have done with your ATV repeater to help in getting around this problem.
- 3) Anything else you might offer. Thank you in advance for anything you might offer. Paul Emeott KOLAV

Repeater Frequency Coordinator - Minnesota

In real life we can consider them insignificant below -60 dB even though the noise floor of your analyzer may be -110 dB. Why? because unless you have a huge antenna gain, -60dBW is 1 microwatt. A typical 3-5 dB gain vertical still leaves it in single digit microwatts, and even a big array of 10-20 dB lifts these sidebands into the tens to hundreds of microwatts. Microwatts don't get far before they are lost in the receivers noise floor. A lot depends on how close the transmitter is to you, its oscillator and amplifier noise, as well as the receiver IF filter characteristics and dynamic range.

The output of an actual average ham FM transmitter creates sidebands of significance that can easily be 30 KHz wide. That's why you hear "splatter" from adjacent 30 KHz spaced channels. Adding a class C solid state amp (choice of manufacturer is yours) increases the RF intermodulation into what we call white noise or transmitter noise. This can be MHz wide and more.

AM modulation has a single carrier, and variable amplitude sidebands. The sideband amplitude is a mirror of the amplitude of the modulation frequency. Because of this, the signal is not "robust" since the sideband energy can be very small compared to the level of the carrier. Measuring 1 dB below the carrier you would find zero sidebands and would say the signal occupied only 1 Hz of bandwidth. Even in a pure tone modulation, you are not like to find a sideband over -6dB below the carrier. The modulator (remembering back to school) generates only 50% of the power of the carrier, and the power is equally divided between upper and lower sidebands. So already the power is down by 75% for the most robust sideband.

In voice AM transmission, the sidebands add to the power output. Thus your power meter would read 10 watts unmodulated, and 15 watts PEP. In video, the modulation subtracts from the overall power. A carrier of 10 watts, modulated with only black and sync will show 6 watts, and with video show only 3-4 watts power! Of that 10 watts maximum, about .5 watt is the audio subcarrier and about .05 watts represent the color subcarrier and sidebands.

DC to light?

In all television transmitters, the sideband energy near the carrier carries the information which you see as objects. Large areas of the picture whether its Homer Simpson or computer graphics or someone's show. The bigger the areas, the lower the frequencies. Most of the picture is made of shapes. The edges of these shapes or lines generate sidebands of higher frequencies, related to their width, just as the "objects" did. The narrower the width the higher the frequency. Think about it as wave-form analysis, or FFT. The greater the change from "black

to white" the more amplitude the edge generates. Looking at any natural video (not a test signal) you will notice that these edge transforms are very small from any point to any adjacent point. Only characters (letters not personalities) generate any significant amplitude as they transition from black to white or white to black.

There is a DC component to TV signals. This relates to the average picture brightness or APL. To preserve this portion of the signal, the receiver and transmitter must pass the majority of the low frequencies as represented by both the lower and upper sidebands. When analyzed by engineers way back when, it was found that the DC level couple be represented to 99% of its actual value by the combined energy of the sidebands that were generated within 1 MHz of the video carrier. In fact, sidebands beyond 1 MHz were insignificant, adding less than 3/10 % to the total power of ANY camera picture. (point three percent) Thus the remainder of the sidebands on one side could be eliminated with no degradation of the picture. Thus the idea of VESTIGIAL sideband transmission came to be. VSB is not SSB. Since the first 1.25 MHz (sloping to 1.5 MHz allowing for filter rolloff) of one side is still used plus the entire opposite side.

Even in a non filtered transmitter this is near the actual value. A VSB filter does most of its work in reducing the lower side or VSB side audio and color subcarriers. This was only done to protect adjacent channel TV reception since the sideband energy is INSIGNIFICANT to any other mode receiver!

TV RECEIVERS

The receiver does not know or care which side has been loped off except for the fact that the IF filters have been set to pass the upper sideband completely and the VSB portion of the lower sideband. By changing the injection frequency to the image frequency, the receiver pass-band has been fooled because although the IF has not changed frequencies, the converter is now sending it the complete lowersideband spectrum plus the VSB portion of the upperside band.

In ham TV, a 439.25 MHz signal as received by the TV set, is the spectrum of 438.00 to 444.00 MHz. By fooling the TV set with an image converter (I guess dual meaning here!) by using high side LO injection in the downconverter instead of the normal low side, the spectrum received is 440.50 to 434.50. Since the significant upper VSB sidebands of the TV signal are up to 1.25 MHz, the spectrum of 438.00 to 440.50 is still occupied by the same TV signal sidebands and energy levels. Since the significant sidebands of the TV signal are within 1.25 MHz

to 1.5 MHz, the spectrum of 438.00 to 440.50 is still occupied by the same TV signal sidebands and energy levels. What has changed is the location of the audio and color subcarriers from + 3.58 Mhz and +4.5 MHz to -3.58 and -4.5 MHz. that the receiver is looking at. Unfortunately, if the ATV station has already invested in a VSB system, such as an AEA transceiver, a filter or units such as the PC Electronics equipment that uses modulation phasing technique to reduce the normally undesired sidebands, the amount of signal to be received has been reduced by 15 to 30 dB! Not too exciting, since that equates to putting a 15 to 30 dB attenuator in line. Try that on an FM signal, it won't get very far either. Fortunately, ham amplifiers add most of the filtered sidebands back because of their IM products and the actual loss is about 6 dB. Still a 75% loss! Again, not too attractive.

POWER PER HERTZ

The FM signal generates its signal with equal amplitude. No matter where in the 16 KHz spectrum you look, except for Bessel nulls) you will find the carrier to be the same 10 or 25 or 150 watts it is at the unmodulated carrier frequency. The AM Video signal sidebands represent a depth of modulation of 26 dB maximum except for a very small number of close in sidebands at frequencies of 30 hz, 60 hz, 15,734 hz that represent the primary sync modulation frequencies. These are all within 60 KHz of the carrier. Remember with even a single tone, no sideband is more than 25% of the carrier power. In video, the sidebands beyond about 120 KHz are more than 20 dB down, The sideband energies decrease rapidly as you get farther from the carrier to where the sideband energies, are below the FCC - (97.3(8) - 26 dB defined "occupied bandwidth" level well before the time you get to 1 MHz removed. At 2 MHz you are lucky to find sidebands more than -40 dBc in a flat amplifier/antenna.

To equate to a 1 watt FM signal, it would require 6 MILLION WATTS of video to generate a 1 watt signal at each hertz of spectrum. I don't think any ATV station has that much ERP. I come close at 1 megawatt ERP from an 8 antenna array. I would need 48 beams (and no loss in the power divider cables) to reach 6 MW ERP! So at best my sidebands beyond 1.5 MHz are about equal to a 1 watt signal. An average station, 40 watts of signal to a 12 dB gain antenna with 2 dB of coax loss = 400 watts ERP at the carrier, and 400 microwatts in sideband energy.

Now compare the 400 microwatts the TV set is trying to receive to the 25 watts from an FM transmitter in the same spectrum and it is NO CONTEST, the FM signal wipes

out the video. Meanwhile, the 400 microwatts tries to hit the 25 watt FM signal in the FM receiver and again NO CONTEST, the FM signal wins. To receive interference the undesired signal in the FM receiver must be stronger than about -10dB below the desired signal. In receivers the desired to un-desired ratio can be as little as 5-6 dB for there to be no interference. Does this mean the squelch will never break? No. It means that unless you are trying to receive a signal with less than a 12 dB SINAD FM signal, (below the limiter saturation value) the video cannot interfere with the FM unless they are darn near on the same frequency and in the same neighborhood. *The FM signal limiter in the receiver ignores the AM signal, just as it does other amplitude noise sources. The TV set does not.* Any signal amplitude above the noise floor of the TV receiver, about 1 microvolt due to the wide bandwidth, that is within the pass band of the receiver will interfere with the picture. ATV pictures require about 200 microvolts to be considered snow free. Depending on frequency and the signal ratios, the interference from an FM voice or packet signal varies from "herringbone" to a completely blank screen. That is why a TV signal requires much more protection from interference than an FM signal. Generally, the sidebands of a video signal +/- 1 MHz from the carrier are about equal or less power than licensed part 15 transmitters!

REPEATERS

The filtering required to operate an in-band ATV repeater is such that although the original TV transmitter can't generate sidebands of any significance to others, it can to the repeater itself. Using usually, inter-digital filters, the sidebands and undesired transmitter noise is reduced to below the threshold of the TV receiver. This is more than 100 dB of attenuation below the video carrier.

To provide this usually requires a VSB filter and a duplexer. Both must be flat over the entire 6 MHz of the video bandwidth with fast rolloff beyond. These are expensive to buy and hard to tune, and not easily moved in frequency. The ultimate effective bandwidth of this design is about 10 MHz before unrealistic reactive components (capacitance and inductance) begin to affect performance, VSWR begins to be too high, or losses are excessive. Because of the limited travel of the screws used to tune these, before arc-over or loss of tuning effect, they are typically not tuneable from one "tv channel" to another. A commercial duplexer at "ham" discount is about \$1500. A high power VSB filter (over 100 watts) is \$350 and a low power (under 100 watts) is about \$150. Yes you can build one if you have a machine shop, spectrum analyzer and sweep generator and network generator at hand. I have published many such filter designs and many ATV'ers have successfully built them in a machine shop from the critical dimensions provided.

All RF connections and cables must be completely RF tight...any leakage will reach the receiver and the isolation is lost. I use N or BNC connectors on all equipment, cables, even power lines at equipment and supply ends with RF filters at each end of power leads, inside the equipment and still get some RF leakage using heliax!

To work with a single antenna, physics only allows a minimum separation of 10 MHz because of filter roll-off. I know of one case where this was reduced to 6 MHz by using a number of "suck out" filters to increase the attenuation in the dead band between receiver and transmitter frequencies. So 421.25 and 439.25 works, 426.25/439.25 works, 421.25/434 works. 434.00 is almost equal to 439.25 inverted sideband operation in terms of spectrum occupancy, except the carrier of the received signal is 5.25 Mhz closer to the transmitter.

Several repeaters have either adopted inverted VSB (also called lower sideband VSB - LSVSB) with 439.25 LSVSB input / 421.25 USVSB output, or have reversed the input/output, both being the normal USVSB, of the TV repeater so the receiver is at 426.25 MHz, well away from the FM voice repeaters. By the way this gives 100 FM voice link channels on 25 kHz spacing from 420-425 MHz or 426-431 depending on the selected video frequency, and plenty of repeater channels 441-445 MHz as long as 442.8-.9 and 443.6-.9 are skipped for the color and sound

subcarriers. Either method reduces but does not eliminate interference to the video system, but is the best we can do until something better can be devised, such as community transponders for narrow mode users (similar to satellites) which would reduce the number of individual narrowband repeaters and improve on the channelized operations. 434.0 MHz USVSB with 421.25 out would also be an option but only for those below the A-line with Canada. Packet can use 431.0 to 431.6 MHz thanks to the new FCC definition of a repeater. Packet users have already adopted a narrower deviation figure to reduce QRM and occupied bandwidth where technically knowledgeable users understand the modulation form.

So again, I suggest that the best path is to have a dialog between the users that you want to bring to the table to look for solutions on BOTH sides of the band, not place the onus of responsibility on any one mode or user. Then come up with an equitable cost sharing approach if changes have to be made.

73 and good luck, Henry Ruh KB9FO
cc: Tom O'Hara W6ORG, ARRL VHF-UHF Technical advisor,
cc: Rollie, Paulson KB0GL, Minneapolis ATV REPEATER,
cc: Robert Bennett, W3WCQ ARRL Spectrum Management Chairman.

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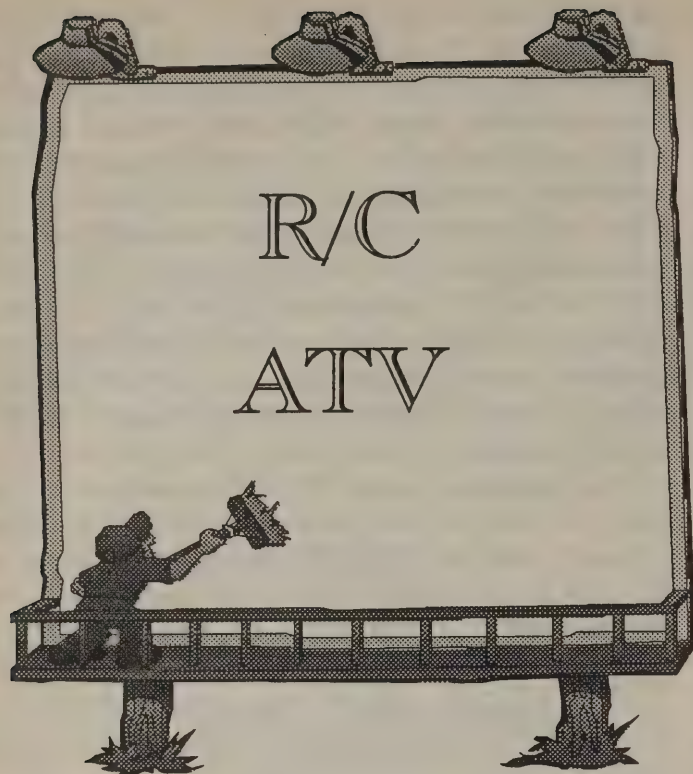
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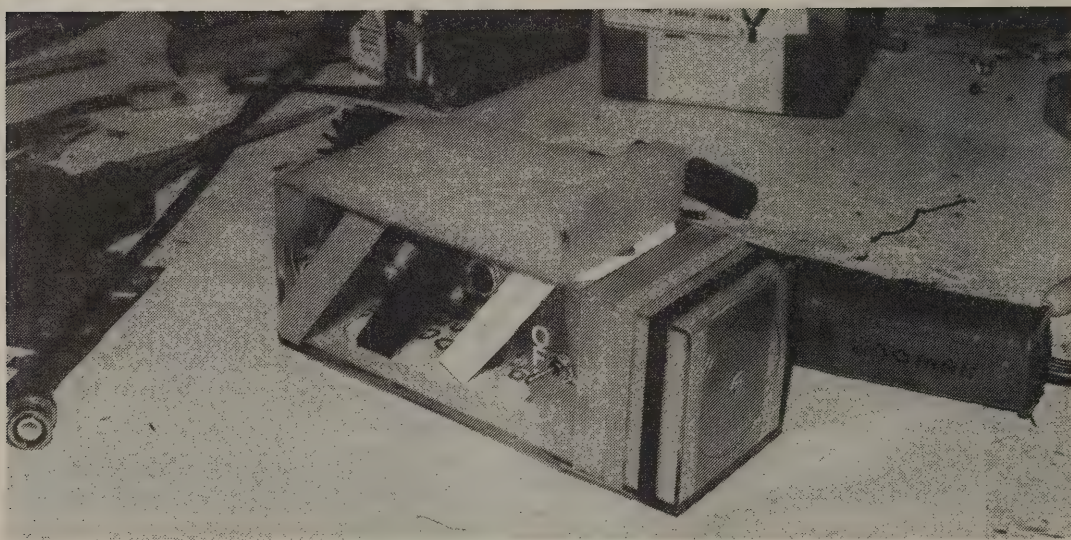
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AIRBORNE AMATEUR TELEVISION AT K7YZZ

by Lou Hutton K7YZZ
12235 SE 62nd St.
Bellevue, WA 98004



Over the last several years there have been some interesting articles published in ATVQ describing airborne ATV systems. Since I have been busy building all kinds of model airplanes since 1990, I decided to try to assemble an ATV system for use on my Shuttle ZX Chopper and my 8 foot wingspan Dynaflyte Butterfly trainer airplane. Henry Ruh learned about my efforts and asked me to tell how it worked out. So here is a description of my experiences with Airborne ATV.

The airborne TV package consists of a PC Electronics TXA5-70a 80 Mw transmitter on 434 Mhz., a FMA5-F ATV Sound subcarrier generator, a RS 270-092 Condenser Microphone element, a 9.6 V battery pack made from 8 ea N-Cells, and a Chinon CX-060 micro black and white video camera. These components are packaged in a plastic pencil box about 6" long by 3 x 3 ". The camera is mounted in the lid of the box on foam packing. (Photo #1) A heavier duty battery, 9.6V @ 600 Ma was assembled to be used in bench and ground tests. The PC boards are mounted diagonally inside the box with the little battery attached by double sticky tape to the inside bottom of the box. A BNC chassis connector was soldered to the rear of the transmitter board and extends out the back of the plastic box. The internal battery provides a run time of around 30 minutes. The complete camera package including the battery and antenna weighs 8 ounces.

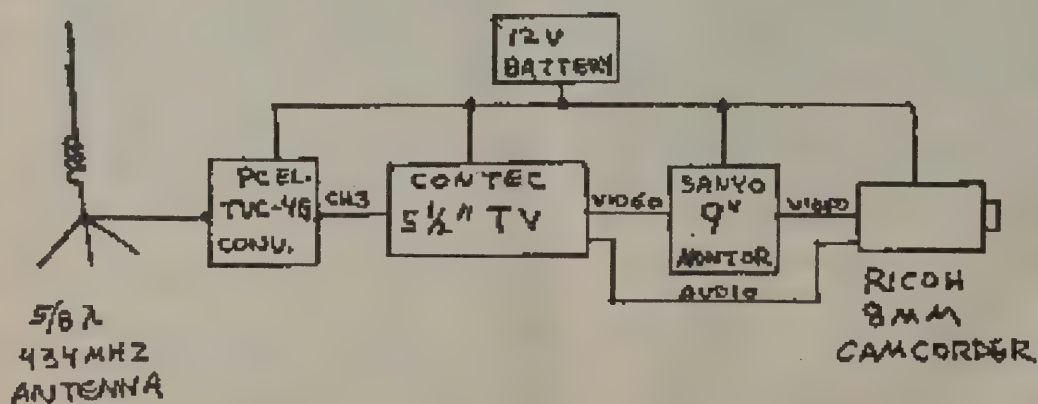
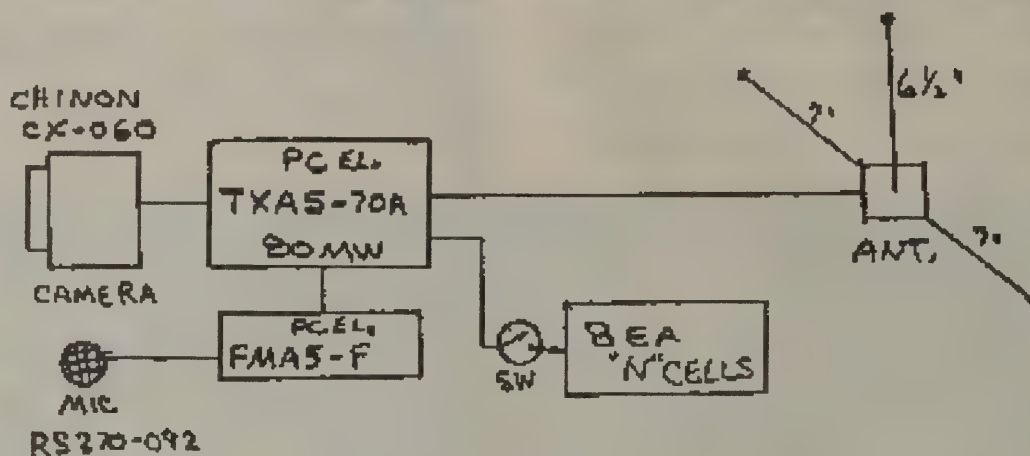
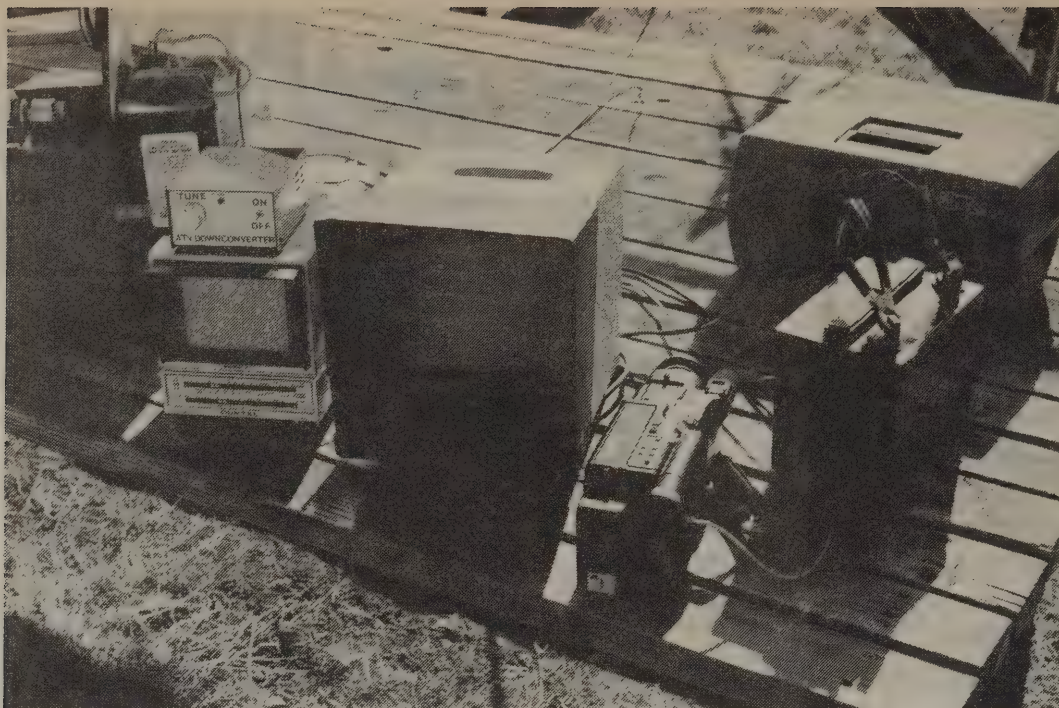
The ATV package is mounted below the airplane fuselage (Photos #2 and 3) with rubber bands attached to dowel rods. The rubber band tension is adjusted to wash out any vibration in the transmitted picture. The antenna is a partial ground plane vertically polarized. On the Chopper installation (Photos #4 and 5); the ATV camera package is mounted below the canopy and attached with rubber bands just like on the airplane. The chopper's ATV antenna is mounted on top of the nose of the canopy using double backed sticky tape. The chopper camera system can be easily removed and used on any other Shuttle ZX by just pushing the cabin release latch and sliding the cabin off with its attached ATV unit and then re-installing it on another similar chopper. Three other Shuttle ZX pilots used this canopy/ATV system on their machines and were impressed with the pictures we recorded of their flying! !

The ground receiving station ~Photos #6 and 7) is made up of the following components The receiving antenna is a home made 5/8 ths wave 3dB gain vertical ground plane antenna mounted on a camera tripod. The

antenna is connected to a TVC-4G GaAsFET 70 cm ATV downconverter packaged in a small metal box with an internal 12 volt back-up battery. External power is fed to the converter from a rear connector. The CH3 output from the downconverter is fed to a small TV set that has both audio and video output connectors. The video output is fed to a 9 inch monitor and from there to an 8 mm camcorder. The sound output from the TV set is also connected to the camcorder. The downconverter, TV set, video monitor, and camcorder are all powered by a small garden tractor storage battery. The total current drain on the storage battery is around 2.75 amps.

Early flight tests on the airplane identified several problems. With the antenna mounted on top of the airplane wing, we found that whenever the signal path had to pass through the arc of the propeller it caused horizontal streaks in the received picture. This was corrected by moving the transmitting antenna back to the rear of the fuselage in front of the vertical fin. Another problem was that when the camera happened to get hit in the lens by the sun, it would blind the camera and mess up the video transmission with lost sync pulses. This was fixed by installing a polarized filter in front of the camera lens. This also really improved the definition of ground objects. Clouds in the sky really stand out and add beauty to the scene. I also had to carefully re-focus my camera and lock its adjustment. On this particular model camera I also noticed that when the battery voltage dropped below its specified minimum the pictures became soft, not really sharp. The focus held up OK but the image gets a soft look. This tells me that it is time to recharge the camera batteries.

To date we have made over a dozen successful flights on the ATV equipped Shuttle ZX chopper. The early flights were like 1909 moving pictures with no sound, just video. Then the sound board and microphone were installed and that made the video even more interesting. Things were going so well that we decided to fly the Butterfly airplane again with the improved video/sound package. All was fine until the test pilot tried some aerobatics. The left wing broke off at the root and the airplane crashed. The camera system worked all the way down until it hit the ground. The PC transmitter board was rammed into the back of the camera and knocked lots of surface



TOP: airborne ATV system components

BOTTOM: ground station ATV system components

mounted parts off of the camera PC board. It also broke the transmitter crystal. The plastic camera box was shattered. Photo #8 is a shot of the remains of the airplane and TV package. Using stop motion recording of the last few seconds of the flight you can see the front wheel bury itself in the grass at the moment of impact. The all goes blank!! The camera has been replaced with a new model and the transmitter repaired. A new airplane (Senior Telemaster) is being constructed to replace the ruined Butterfly. On this new model the camera head is lowered in and out of the cargo hold by an electrically driven servo. All other electronics remain secure inside the cargo hold. It is scheduled to be given its first flight in the spring of 1996 after the rain lets up a bit here in the Pacific Northwest.





SO. CALIF. ATV GOES NORTH MOUNTAIN TOP CAMERA PIONEERS

by: Lee Kelly - K6ZVA

What happens when an avid ATV ham moves from a Southern California qth to the Oregon trail country of South Idaho? I can answer that in one word, "nothing". My Anaheim California ATV log sported about forty active hams working Mt. Wilson and Santiago Peak. I knew beforehand there would be some pioneering needed from checking the repeater directory. There was some ATV activity in Boise but that's it for the rest of the state. We moved to small town America, Twin Falls, south central Idaho. It's about 45 miles from the Nevada border. First thing after the ham shack got well, was to monitor 2 meters. It was real quiet. Then one day a magical signal appeared!, a real live repeater!. Things were not as bad as I thought. After more monitoring several more repeaters were logged. In my excitement I didn't really listen to conversation!. This is most definitely corn ,cow, potato, tractor, barn, goat,



etc: country. Now a certain amount of panic set in. The real problem was to locate someone among these "ham communicators" that actually was interested in ham radio!. I finally found (a hams ham - K7HK) who, as myself, had a high interest in ATV but alas, nothing was happening. He worked for the local BLM district as the communications maintenance technician. It seemed worthwhile to undertake an ATV repeater project even if it was just the two of us!. So with the wonderful understanding of my wife, I built a darn good repeater. In on 434, out 1253. This choice of frequencies became clear after all the difficulties with 421- 439 inband signals. No amount of filtering, shielding and best construction practice could completely eliminate crosstalk. Antenna separation was a problem on the small initial building site provided by my friend, (BLM). This location was 50 miles from both of us and 500 ft above the terrain. Harry, my friend, lives in Albion, Idaho behind a 5000 ft mountain!. Now Mt.Harrison had a great deal going for it. At 5000 ft. above the valley !. It had a small ham building housing packet and a couple of 2 meter repeaters. We very carefully advanced the idea of installing an ATV repeater in this sacred site. The site was built and occupied for 20 years with lots of gear donated and orga-



nized by the Idaho Society of Radio Amateurs. "What is ATV", they said. Now that's scary!. We are talking

pioneering here!. After we explained how we would install a very innocuous wall mounted repeater that would never ever interfere with any of their stuff and would only consume 35 watts of standby power and I would help them with their other problems, they said "OK".

Severe interference from the third harmonic of the 145.01 packet machine falling inside the 434 receiver input does cause problems. Unfortunately, this is the backbone transmitter for all of southern Idaho and is very busy. The ATV signals are excellent for many miles throughout the valley. It is about 50 miles from my location, P5 plus pictures here. We are ready for business!. Where the heck are all the fired-up ATV people!. One more great guy - WA7NRP came on board. He is the president of the ISRA. Now there are three of us.

I am one of these retired guys with not a lot to do except pester my wife and think of very expensive ways to alleviate my amateur radio pains. While wondering what I might do with a nice new spare Sharp camcorder, an idea lighted the room. How about putting this camera up on top of the mountain so we could look at the tower and antennas, remote controlled of course!. At 9000 ft. A.M.S.L., with temps to 40 below and winds up to 125 mph, what could possibly be any trouble?. But wouldn't this be a great way to generate interest in our mode?!. Well sure but what about those other minor things?.

Some kind of weather-proof enclosure, heated and very rugged would be needed. I'm only kidding about having discretionary funds for this hobby!.

Remember - never, never throw anything away when you move!. The stuff in my garage imported from So.Cal. became a treasure-trove of goodies to make a very good remotely controlled mountaintop installation. I will not go into details of the project but let the photos speak for themselves. Suffice it to say, the project took nearly a year of building and environmental testing in my lab and backyard. The DTMF 2 meter camera control unit design was equally daunting. Motor control



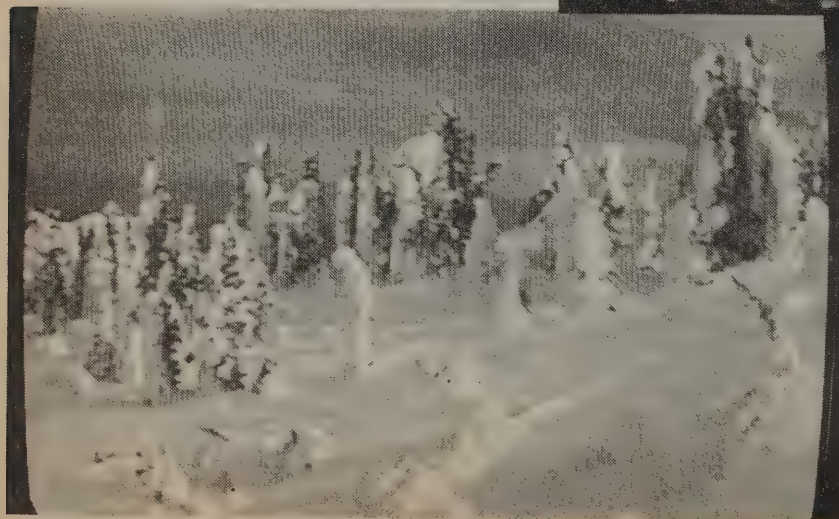


relays created voltage spikes that were very difficult to prevent reaching the digital circuits. The camera can elevate plus or minus 75 degrees, zoom x12 and rotate 360 degrees. It has performed well so far in snow and ice. I will need to install a de-icing device so that it will work during storms without waiting for the temps to get above 35 degrees.

Did this fantastic project produce an instant interest in ATV?. Very slowly I am hearing some of these people saying, "what can you see on the hill" and "as soon as I can see my way clear". The other day a member of

search and rescue called me to ask if I could pan up the tower to see if their antenna was in trouble. They were not able to access their repeater. I was able to see a fractured cable feeding it. Now they can snowmobile up there and climb the tower if I tell them the tower is clear of ice!.

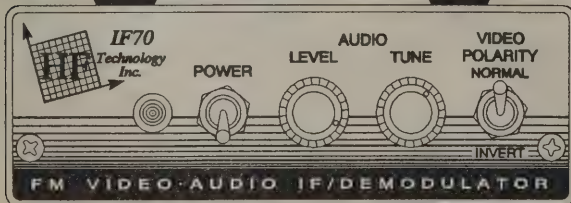
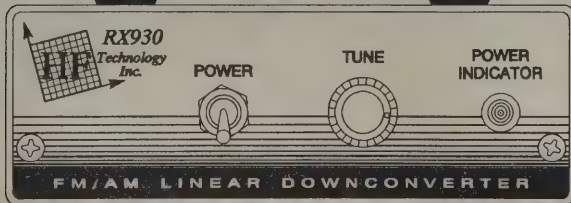
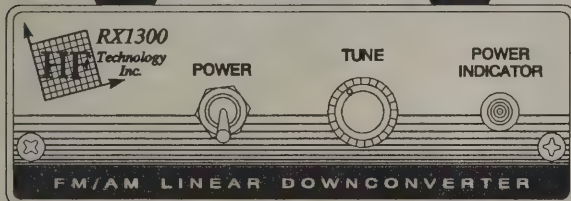
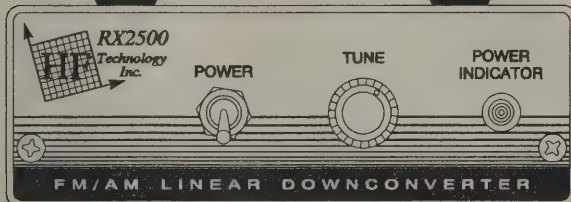
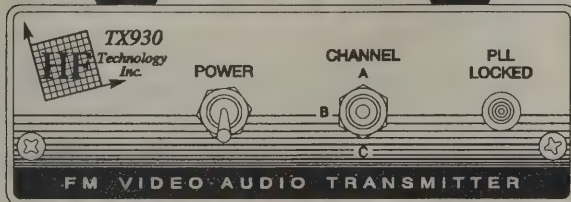
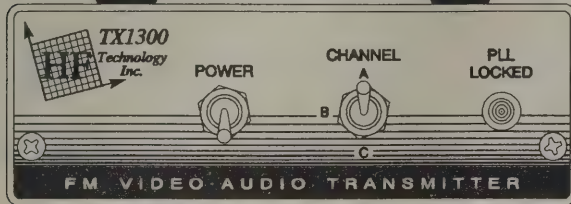
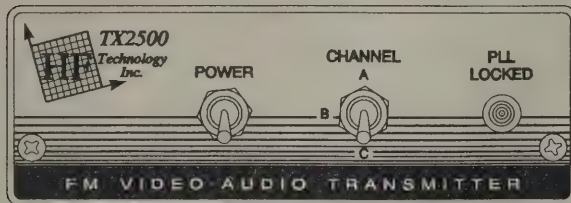
I would be very glad to discuss the details of this project with any of you who might be interested. You may contact me at: (208) 734-7785 or write to: Lee R. Kelly 570 Park Terrace, Twin Falls, Idaho 83301



Editor: Repeater owners claim this is a view of their mountain top, I think there were confused with the view of Buffalo, NY!



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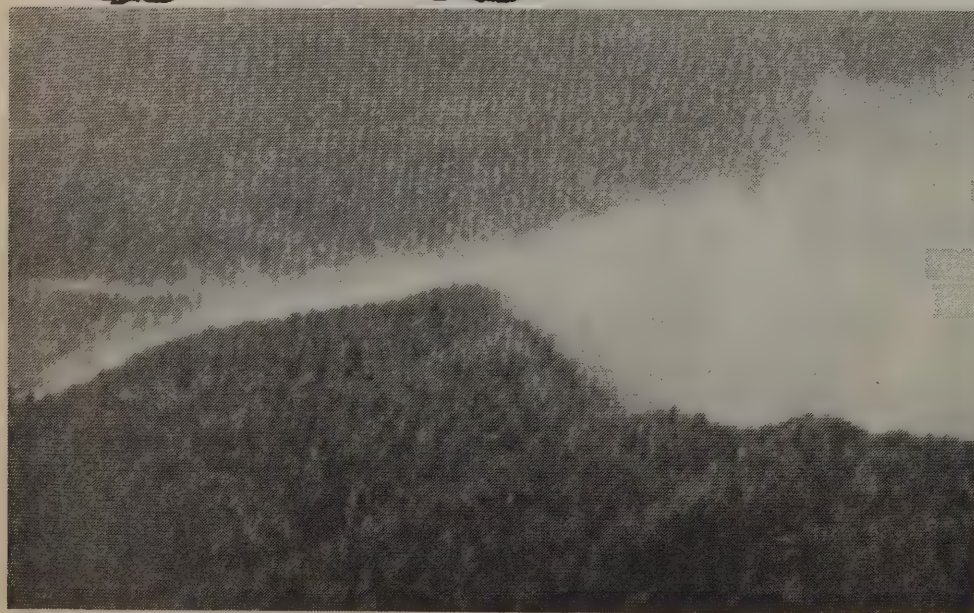
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KB7BY

Remote Camera

Author: Lyle Bell, AA7AU



These pictures of a desert brush fire were taped on August 12, 1995 using the KB7BY Remote Camera located on Mt. Potosi, 20 miles to the southwest of Las Vegas at an altitude of 8500 feet. Geoff Gomes, KB7BY, was operating the camera while Lyle Bell, AA7AU, taped the action.

The camera is connected to the KB7BY ATV Repeater, which is linked to the ATN in Southern California. KB7BY is responsible for designing and building the major components of the system, including a controller. The equipment at the site includes:

- 1.2 GHz AM repeater transmitter
- 2 GHz ATN FM link receiver
- 913 MHz FM repeater receiver
- 1.2 GHz FM link transmitter to another site in Las Vegas
- .434 Mhz AM repeater receiver
- 146.43 voice receiver
- 1.2 GHz FM ATN link transmitter
- Amiga 1000 computer for video IDs

The controller supports additional inputs from the color camera and an auxiliary source. The system is DTMF-controlled through either one of two receivers.

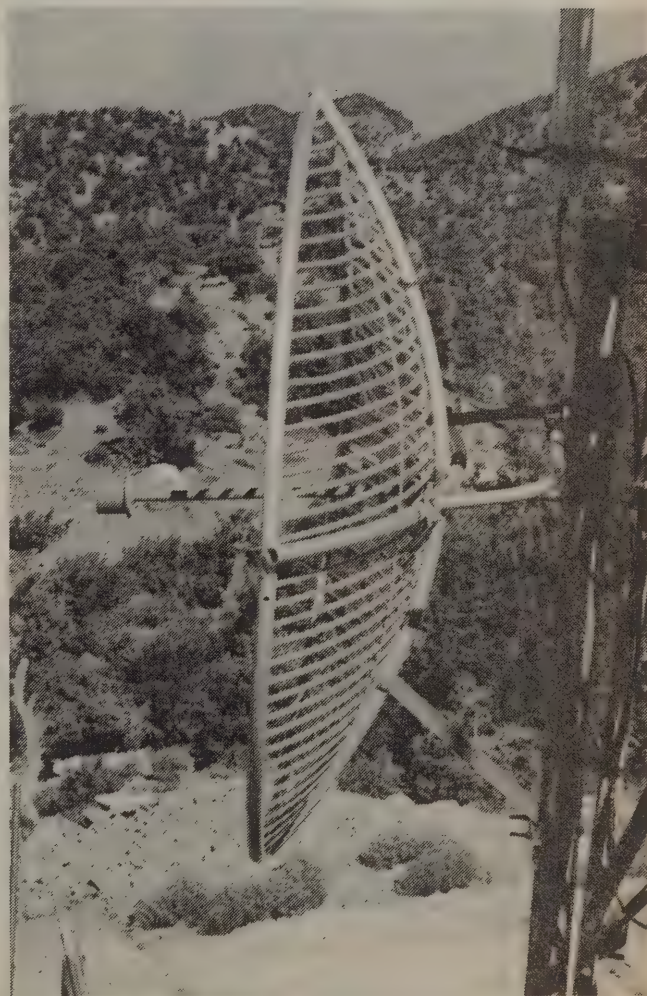
The Remote Camera was first installed in the Fall of 1993. Geoff designed and built a separate DTMF controller to handle the pan-and-tilt head as well as the zoom, focus and iris functions for the Canon F1.8 16mm - 160mm electronic news gathering (ENG) lens. The camera itself is a DC operated Sanyo 1/2 inch color CCD.

We enjoyed pictures from the mountain for about two weeks after the initial installation, when temperatures started falling below 40 degrees. A temperature sensor in the dome connected to an Advanced Computer Controls RC 850 repeater controller permitted for the tracking of highs and



lows. A number of trips in VERY COLD conditions were made that year to get the heating system to work and fix other bugs (like wires getting tangled in the pan-and-tilt head). After the first winter, when temperatures on the mountain were frequently near zero, the original lens and pan-and-tilt head were replaced with units better able to withstand the environment. All of the equipment stood up very well last winter and provided some spectacular views of radial ice and deep snow drifts.

The ENG lens was fitted with a doubler in 1994, permitting us to watch planes take off from McCarren Airport and follow them out of the valley. The lights of Las Vegas are always visible at night.





Building and maintaining this Toy has been a major challenge in many respects. Watching planes fly over fires that are BELOW you makes it all worthwhile! - - and sometimes even our wives believe us .

KB7BY Remote Camera Picture Descriptions

Pg 38 bottom The lightning-caused fire was about five miles to the west of the repeater site in the desert foothills.

Page 38 top: The camera, with a 16mm to 160mm motorized zoom lens and a doubler, was zoomed in tight when trees on top of the ridge exploded in flames. PAGE 39 top: Left to right - - Lyle Bell (AA7AU), Geoff Gomes (KB7BY) and Ralph Decker (N7TND) with the camera in the background. The three of them are responsible for the installation, as described in the article.

LEFT: KB7BY on a 40 foot tower preparing to install a 1.2GHz FM link antenna.

PAGE 39 left: Close-up of the camera enclosure, which is 30 feet up on a large mast. The dome is heated in the winter, when there are spectacular views of radial ice on the towers - - sometimes up to 10 inches thick

PAGE 39 bottom: . 2 GHz feed horn receives a P5 picture from the Blue Ridge FM link, 170 miles to the west.

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Harlan Technologies announced **COLOR Slow Scan TV for the Sound Blaster** sound card at the 1994 **Dayton Hamvention**. The new version V1.2 is an upgrade which adds Martin 1 and Martin 2 to the list of modes. Other improvements include speeding up the display of pictures, new drivers for both video and sound, **COLOR SNOOPER** which shows the color levels in a picture line by line, adds your callsign to pictures that you send, and allows voice and .PCX pictures to be stored in separate directories.

COLOR Slow Scan will **SEND** and **RECEIVE** Robot 8, 12, 24, 36 second black and white, Robot 36 and 72 second color (displaying in **COLOR**), Scotty 1 and Scotty 2 (displaying in **COLOR**), and now in Martin 1 and Martin 2 (also **COLOR**).

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COLOR Slow Scan can be ordered from **Harlan Technologies, 5931 Alma Dr., Rockford Illinois 61108 (815) 398-2683** (fax (815) 398-2688) for **\$99.95** plus \$5.00 shipping (overseas shipping \$10.00). Illinois residents add \$6.25 tax.

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I am not enclosing the usual color catalog in subscriber copies this issue.
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PROsat II Display Sub System:

Decoder Board and Software, Model TS-VGA SAT 4	<u>\$249.00</u>
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137 Scanning Receiver, Model TS 137-Rcvr.	299.00
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The cost of a complete 137 MHz System is \$886.00 (\$249 + \$637)

The cost of a complete 1691 MHz System is \$1023.00 (\$249 + \$774)

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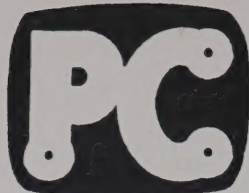
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≥10 Watts
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TC70-10 Transceiver lets you get on ATV right away with all the power most will need in one box - *90 Miles line of sight

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DX is up to *90 miles snow free line of sight using 14 dBd beams and 100 ft. of Belden 9913 low loss coax.

Transmitting equipment sold only to licensed Tech class or higher Radio Amateurs, verified in the Callbook, and used for legal purposes per 47 CFR part 97. If newly licensed, moved or upgraded, mail or fax a copy of your license or test certification.

- Adjustable peak envelope power RF output
Typical range from 2 to ≥10 Watts allows proper adjustment to fully drive the RF Concepts 4-110 or Mirage D1010-ATVN to full 100 Watts p.e.p., without sync or audio clipping.
- Separate mic and line audio volume controls
Allows voice over commenting when showing video tapes.
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lets you set the video gain control for actual white level in your video monitor. Camera video is at this phono jack during receive for focus & lighting set up before transmitting.

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COMPLETE 420-450 MHz 70cm BAND ATV STATION



Your TV set

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Your video camera
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TC70-10....\$499

ATV Transceiver

10 Watts p.e.p. min.

Downconverter tunes 420-450 MHz

Req. 13.8 Vdc @ 3A power supply

Specify transmit frequency(s):

439.25, 434.0, 427.25 or 426.25 MHz

Optional 100 Watt Amplifiers

RF Concepts 4-110.....\$359

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Req. 13.8 Vdc 25 Amp pwr supply

Antennas - see pg. 5

Rutland FO22-ATV 15.8 dBd \$139

Swiech COY43419EL 14dBd \$129

KLM 440-16X 14dBd \$139

KLM 440-10X 11 dBd \$77

KLM 440-6X 8.9 dBd \$60

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